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National Instruments ASEAN

• GRAPHICAL SYSTEM DESIGN •

ACHIEVEMENT AWARDS

Contest is Now Open!

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Submit your most innovative solution for test, measurement and automation to the 2013 NI ASEAN Graphical System Design Achievement Awards – the technical paper contest that showcase the most innovative use of graphical system design from students, academics, researchers and industrial engineers.

If you think your application is technically challenging, beneficial and it is an excellent showcase of computer or network based measurement and automation, what are YOU waiting for?

Submit your most innovative application to us today!

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Contest Segment

Industry	Academic	Awards Category:	Special Award of the Year
➢ 1 Winner ➢ 1 Honorary Mention	➢ 1 Winner ➢ 1 Honorary Mention	➢ Best Innovation in Biomedical & Pharmaceutical Applications ➢ Best Innovation in Renewable Energy ➢ Best Innovation in Robotics ➢ Best Innovation in Wireless Technology Applications	➢ Editor's Choice

Visit www.ni.com/asean/gsdawards for more details

* All participants will be awarded a Certificate of Participation and a "Thank You" Kit

Just submit a video together with your paper exemplifying your technical application, and you will be rewarded with an Additional BONUS GIFT!

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Paper Submission Closing Date	Finalists Announcement	Results Announcement
07 June 2013 (Friday)	28 August 2013 (Wednesday)	3 October 2013 (Thursday)

- ✓ Contest Submission Forms are available at:
  - Download : **www.ni.com/asean/gsdawards**
  - Email : **asean.info@ni.com**
- ✓ Get your copy today!

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LabVIEW và Nền Tảng Giảng Dạy & Nghiên Cứu Đo Lường, Điều Khiển, Tự Động Hóa và Viễn Thông

Đại học Kỹ Thuật Công Nghệ TP. HCM - HUTECH
TP. HCM, ngày 03/04/2013

Phạm Quốc Hùng
Kỹ sư hệ thống
Tel: 09 32 52 92 88
Email: quochung.pham@ni.com

Website: http://vietnam.ni.com

Địa chỉ: Phòng 1903A, 72-74 Nguyễn Thị Minh Khai, quận 3, TP. HCM

Toll-Free: 1800 585837

Agenda

- Overview of National Instruments
- LabVIEW and Its Applications
- PC-based Measurement and Control Technologies
- NI Platforms for Teaching and Research
- Conclusions

NATIONAL INSTRUMENTS™

National Instruments – Our Commitment

We equip engineers and scientists with tools that accelerate productivity, innovation, and discovery.

National Instruments – Our Stability

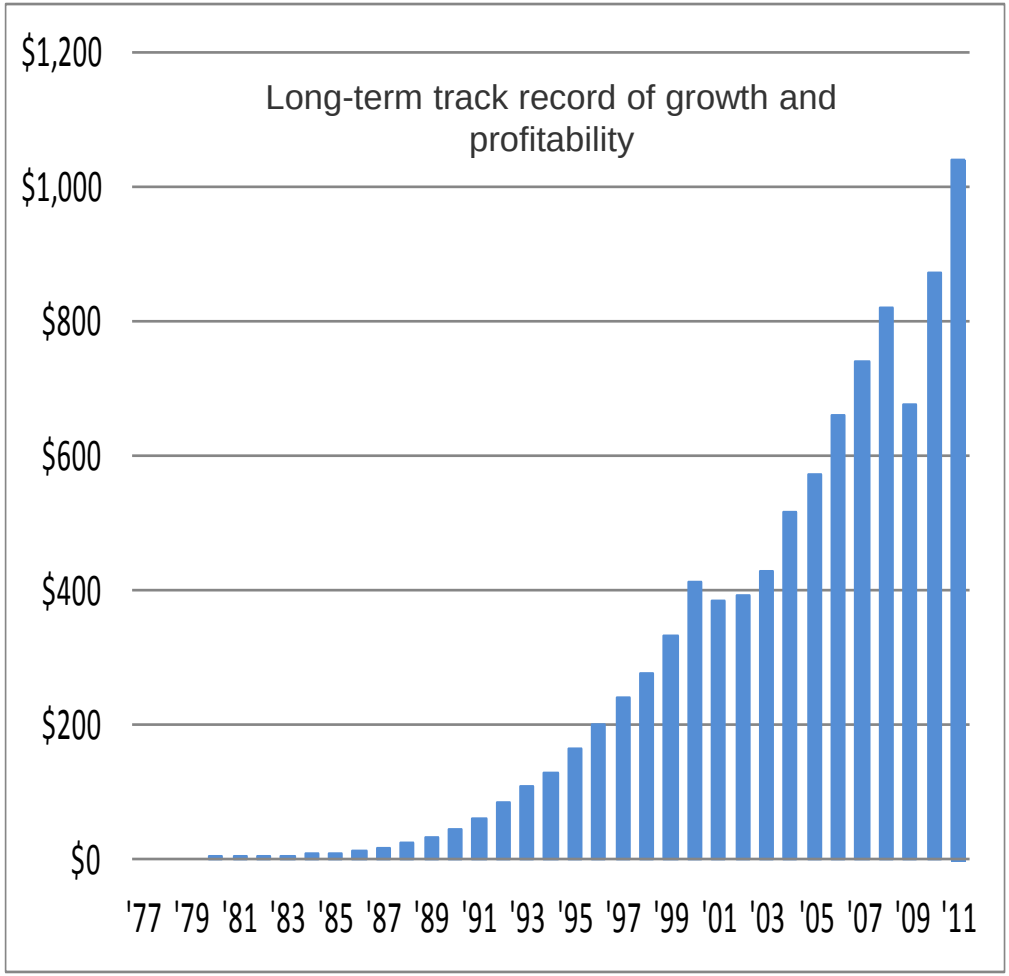
Revenue: $1.14B USD in 2012

Global Operations: ~6,200 employees; operations in more than 40 countries

Broad customer base: More than 35,000 companies served annually

Diversity: No industry >15% of revenue

Culture: Ranked among top 25 multinational companies to work for worldwide by FORTUNE Magazine and the Great Places to Work Institute

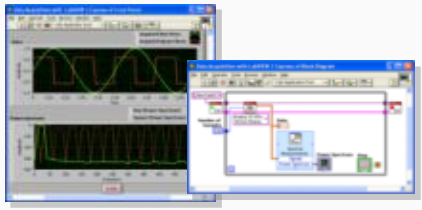


National Instruments – What We Do

Graphical system design combines graphical programming software with modular hardware, leveraging the latest technologies

Low-Cost Modular Measurement and Control Hardware

Productive Software Development Tools

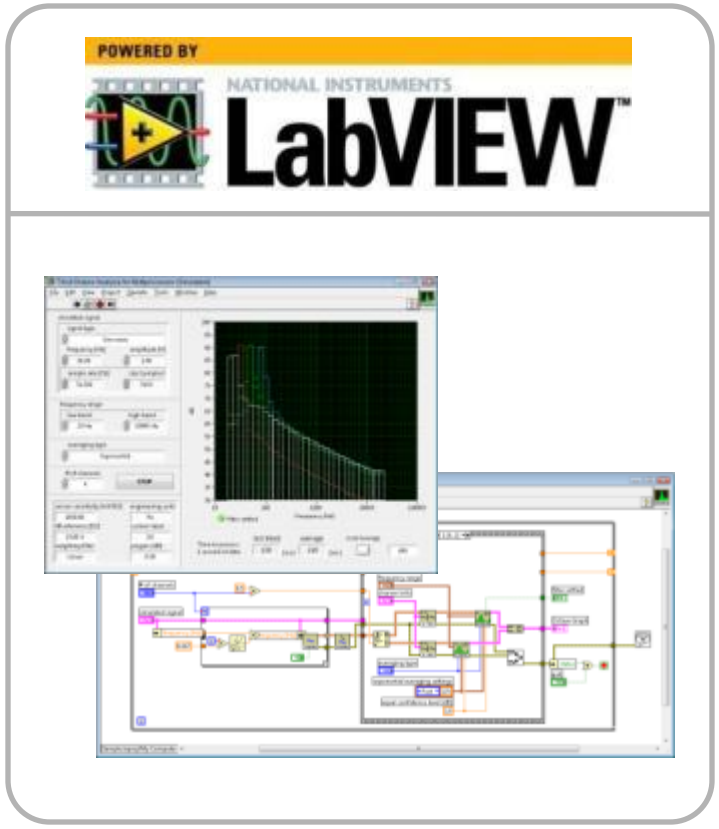


Highly Integrated Systems Platforms

Empowering Users Through Software

Providing unique differentiation and preserving investments

LEGO® MINDSTORMS® NXT
"the smartest, coolest toy of the year"



Video

SpaceX
"first private space company flew to ISS"

Graphical System Design

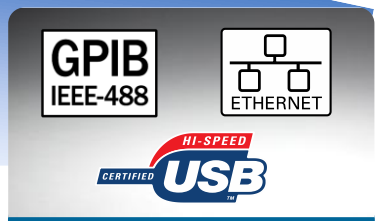
A Platform-Based Approach for Measurement and Control

NATIONAL INSTRUMENTS LabVIEW™

Desktops and PC-Based DAQ

PXI and Modular Instruments

RIO and Custom Designs



Open Connectivity with 3rd Party I/O

National Instruments in Academia

National Instruments in Industry

We serve more than 35,000 companies annually

Direct Operations in More than 40 Countries

Global team of technical sales engineers

Systems engineers to assist with reference and application designs

Local technical support worldwide

World class NI Services

600+ Alliance Partners worldwide

Agenda

- Overview of National Instruments
- **LabVIEW and Its Applications**
- PC-based Measurement and Control Technologies
- NI Platforms for Teaching and Research
- Conclusions

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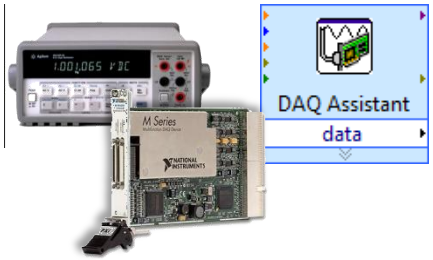
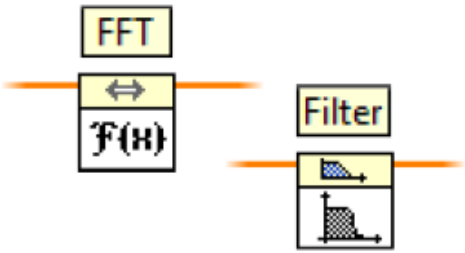
LabVIEW™

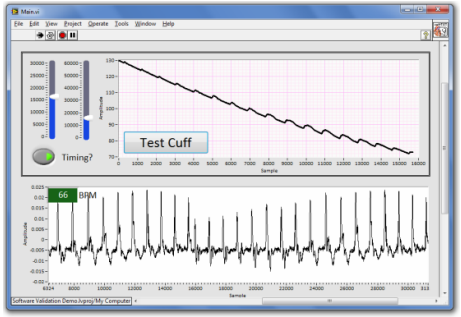
A Highly Productive Graphical Development Environment for Engineers and Scientists



APIs and Drivers

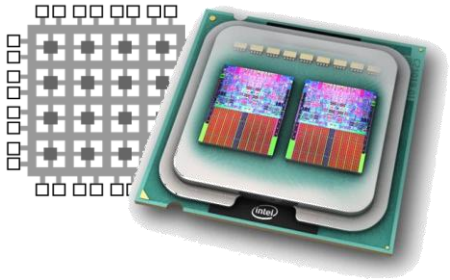


Analysis Libraries

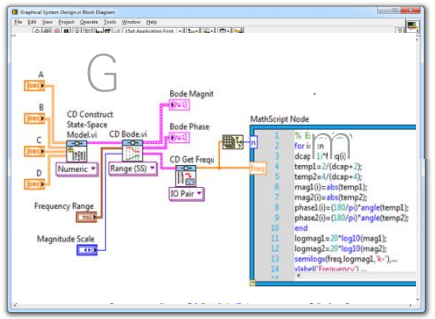


Custom User Interfaces

Deployment Targets



Technology Abstractions

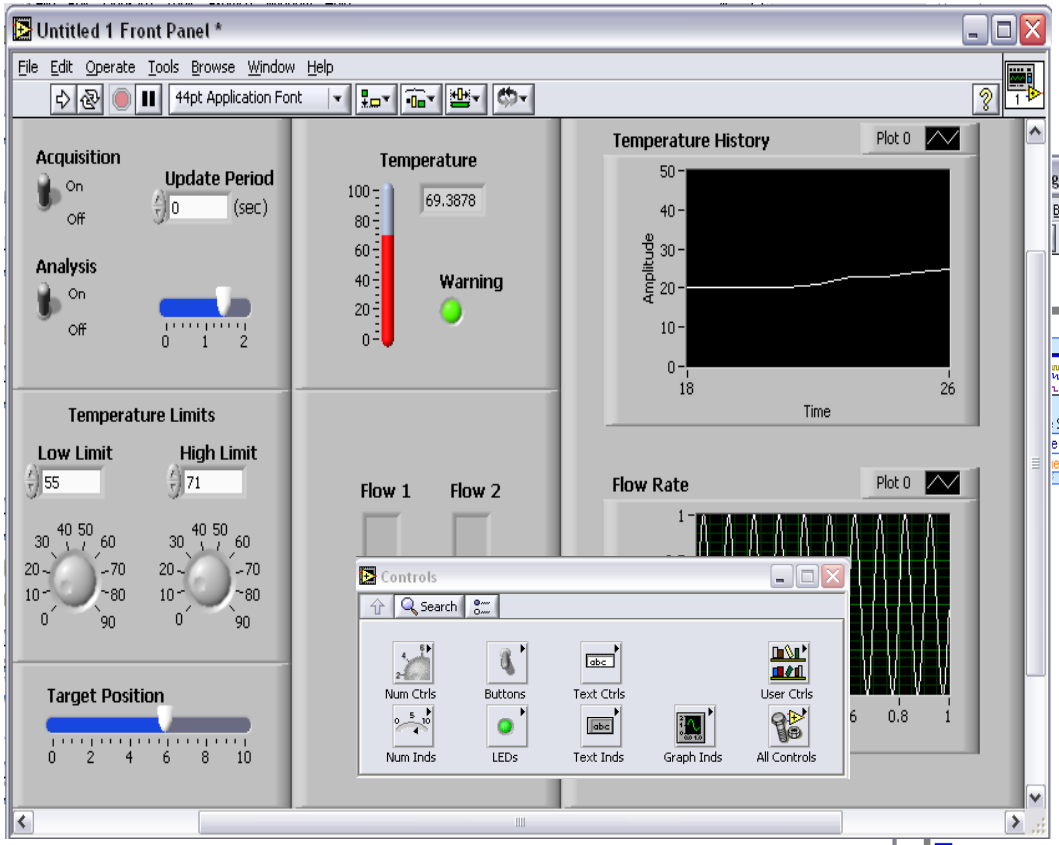


Programming Approaches

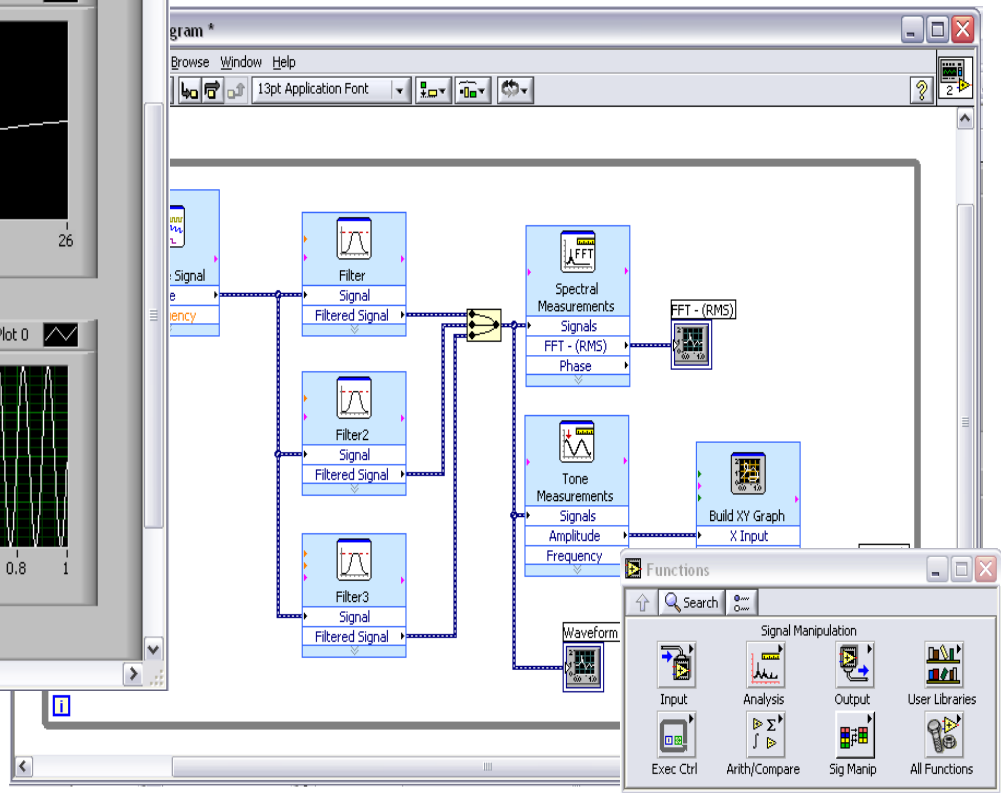
The LabVIEW Environment

Demo

Front Panel – User Interface



Block Diagram – Program Logic



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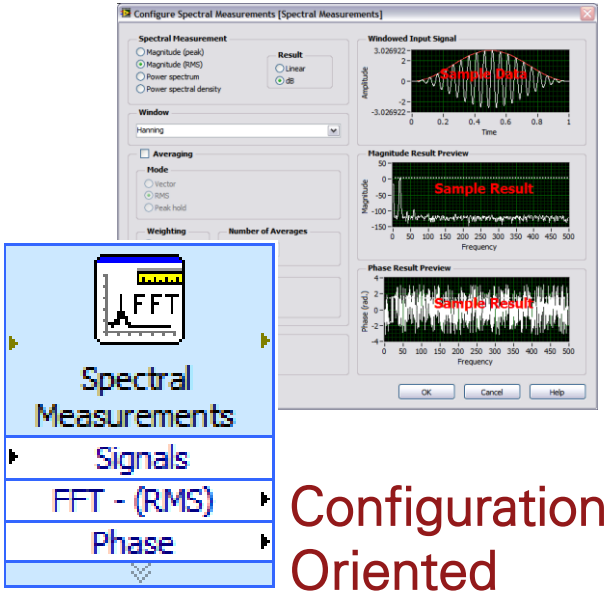
Choose Your Analysis Approach

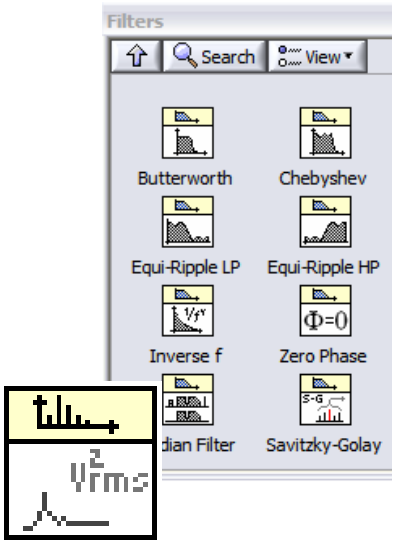
LabVIEW has over 600 built-in analysis functions

Express VIs

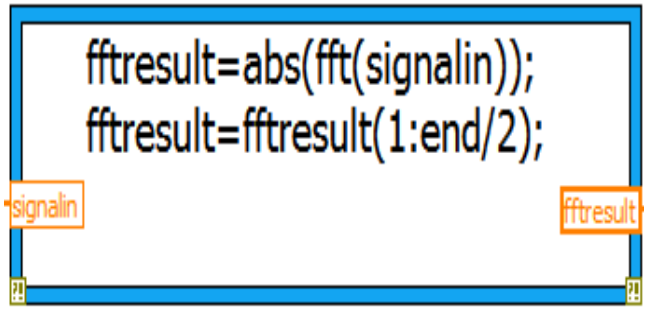


Configuration Oriented

Standard VIs



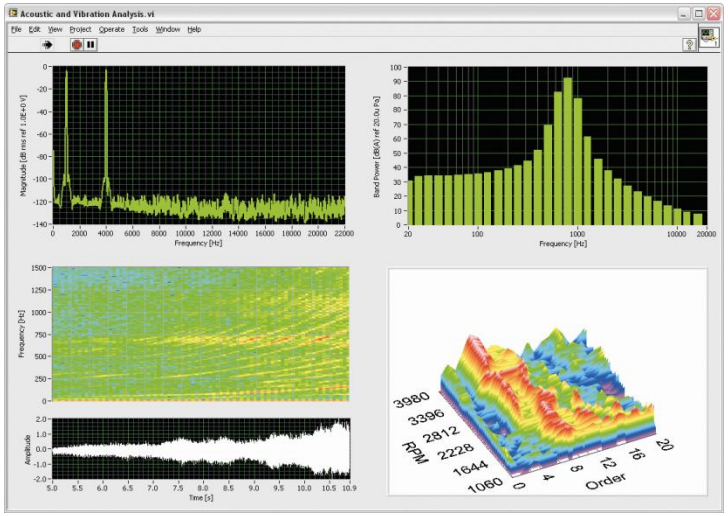
LabVIEW MathScript



Textual Math

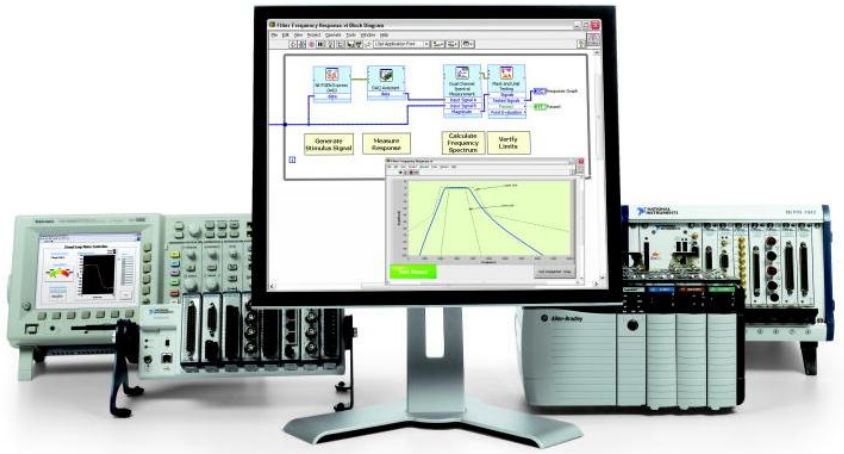
LabVIEW Has Built-in Engineering Libraries

- In-line and off-line analysis and control
  - Signal processing
  - Analysis and filtering
  - Complex math
  - PID
  - Vision
  - Motion



LabVIEW Easily Connects to Hardware I/O

- More than 10,000 instruments from over 350 vendors
- PCI, PCI Express (PCIe), PXI, PXI Express (PXIe), USB, Ethernet, serial, GPIB, and CAN devices
- Modular data acquisition hardware from DC to 26.5 GHz
- Motion control stages
- Cameras
- Hundreds of PLCs



Video

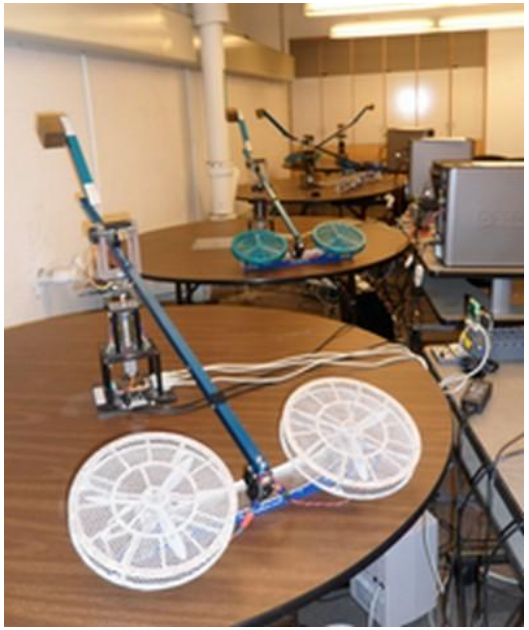
Demo

MIT Students Use LabVIEW and CompactRIO to Design and Implement a Dynamic Output Feedback Controller

Challenge: Giving students the tools to implement control designs on real-world hardware, including a simulation environment for prototyping and validating their controllers to help overcome the challenges of moving from theory to practice.

Solution: Using NI LabVIEW software and CompactRIO hardware as a control platform to design and prototype controllers in simulation and implement them in real-world systems using a unified software architecture that easily takes students from the simulation environment and with a toggle switch on the LabVIEW front panel to deploy their controller to the physical hardware.

Products: CompactRIO, LabVIEW Real-Time Module, FPGA Module, MathScript RT Module, Control Design and Simulation Module, LabVIEW



"Overall, the LabVIEW framework gave students the freedom to take greater control of the hardware controller design process." - Professor Jonathan How - Massachusetts Institute of Technology

http://sine.ni.com/cs/app/doc/p/id/cs-13446

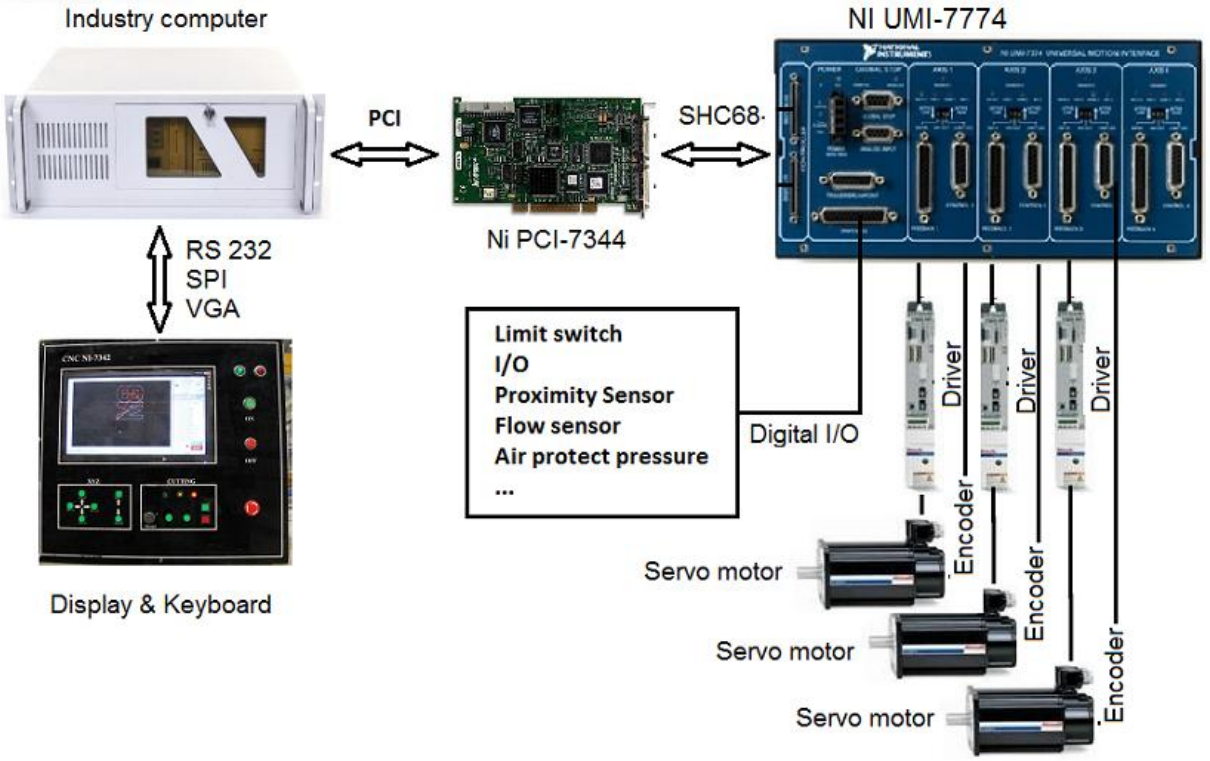
Developing a Low-Cost Computer Numerical Controller Using NI Motion Controllers and NI LabWindows™/CVI Software

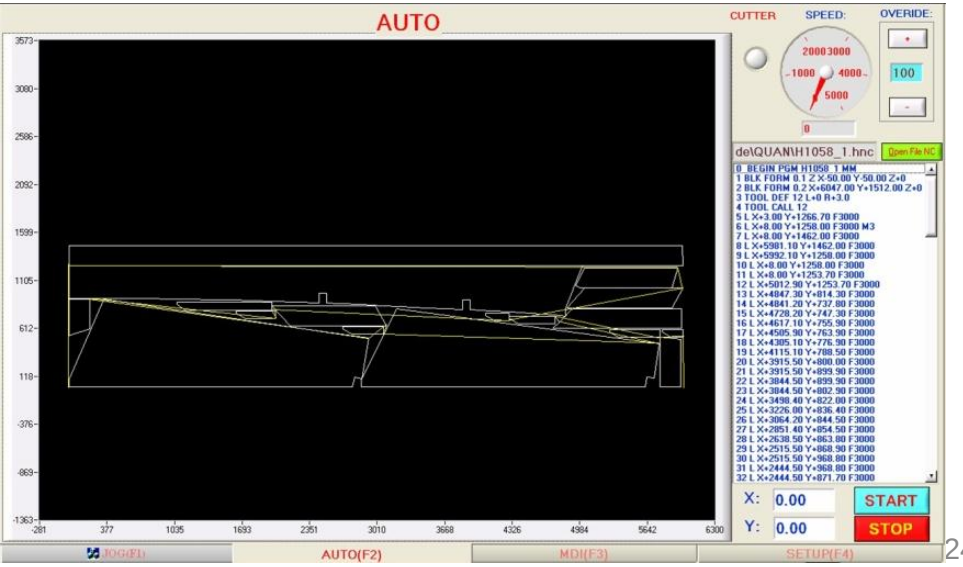
http://sine.ni.com/cs/app/doc/p/id/cs-13821

Challenge: Creating a low-cost computer numerical controller (CNC) system with extremely high speed and accuracy for use in industrial shipyards around the world.

Solution: Using NI motion controllers and NI software to build a flexible, low-cost system to meet a variety of customer specifications.

"By using an NI motion controller and taking advantage of extensive NI customer support, we created software which makes the CNC less expensive, easy to install, and widely applicable in our industry."
– Khanh Phan Van, Institute of Applied Mechanics and Informatics

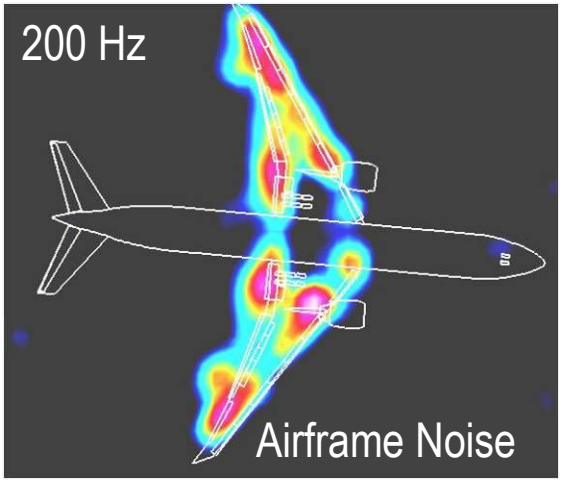

Industry computer
NI UMI-7774
PCI
SHC68-
Ni PCI-7344
RS 232
SPI
VGA
Display & Keyboard
Limit switch
I/O
Proximity Sensor
Flow sensor
Air protect pressure
...
Digital I/O
Driver
Driver
Driver
Encoder
Encoder
Encoder
Servo motor
Servo motor
Servo motor

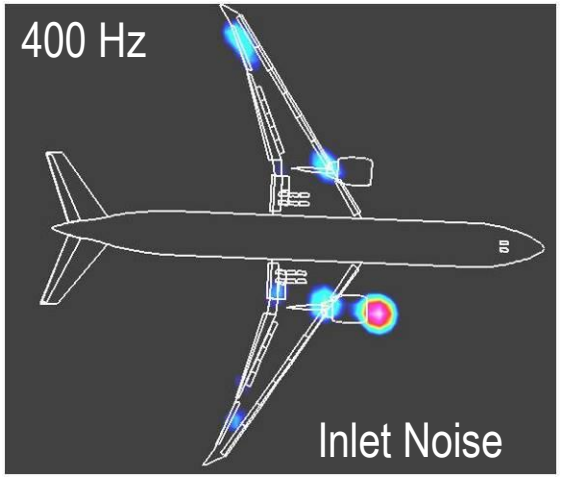

AUTO
CUTTER
SPEED:
OVERIDE:
100
START
STOP
X: 0.00
Y: 0.00
JOG(F1)
AUTO(F2)
MDI(F3)
SETUP(F4)

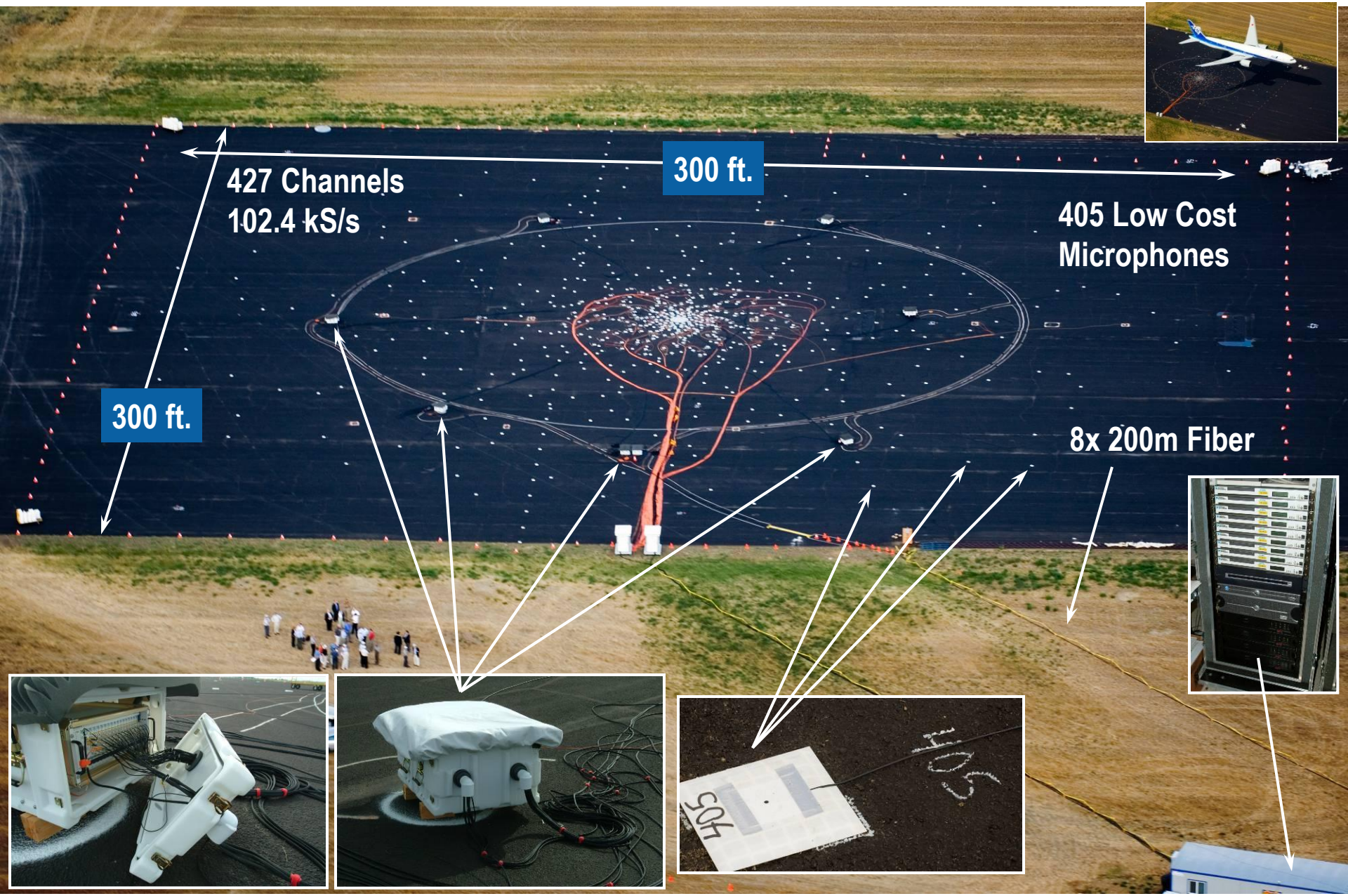
CNC NI-7342
ON
OFF
XYZ
CUTTING

Boeing: Flyover Test

448-channel Microphone Array






427 Channels
102.4 kS/s
300 ft.
405 Low Cost
Microphones
300 ft.
8x 200m Fiber

Agenda

- Overview of National Instruments
- LabVIEW and Its Applications
- **PC-based Measurement and Control Technologies**
- NI Platforms for Teaching and Research
- Conclusions

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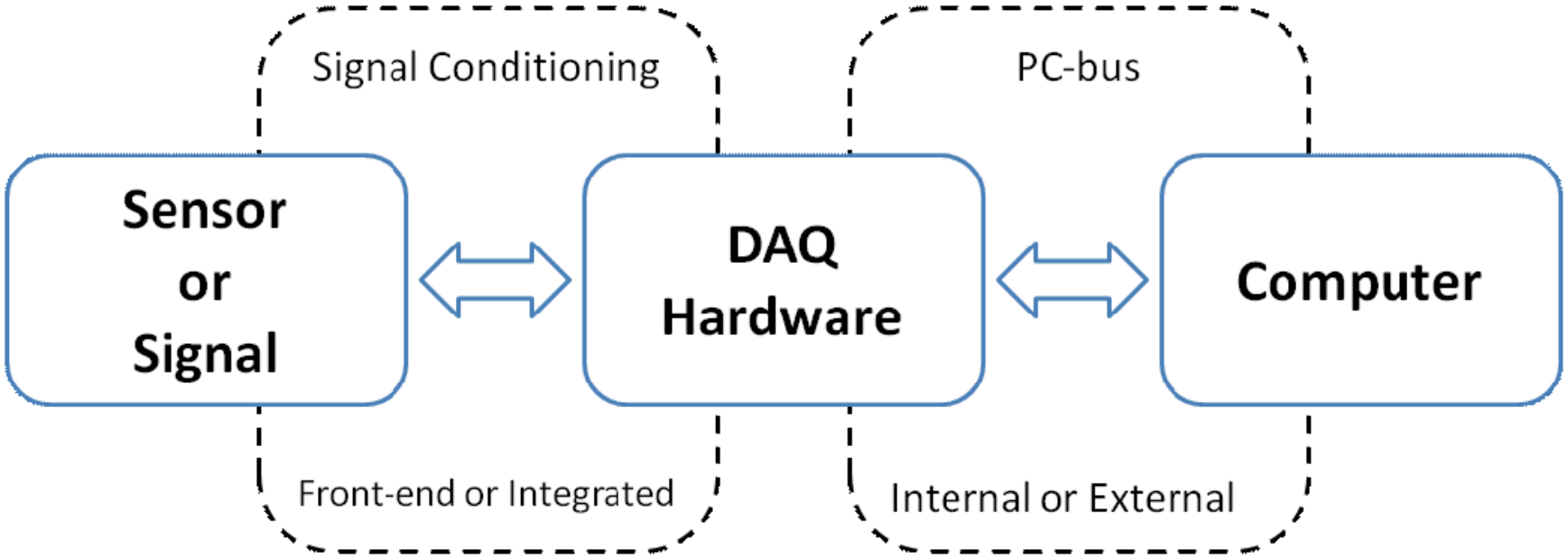
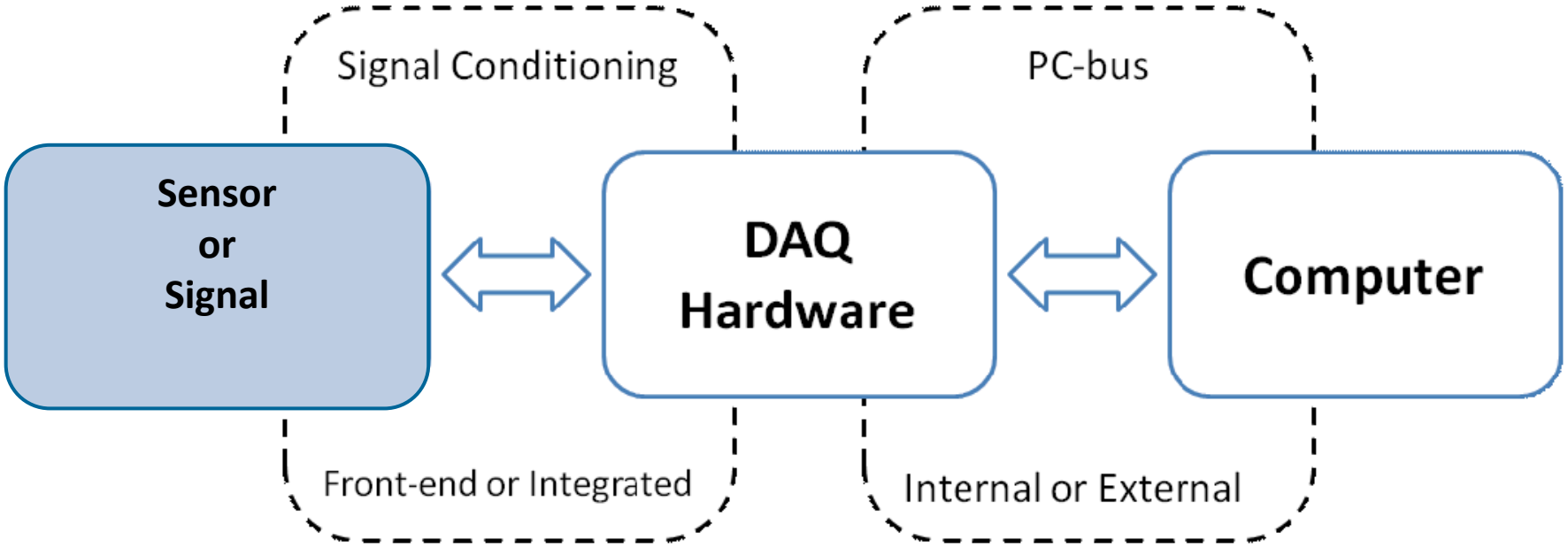
What is Data Acquisition (DAQ)?

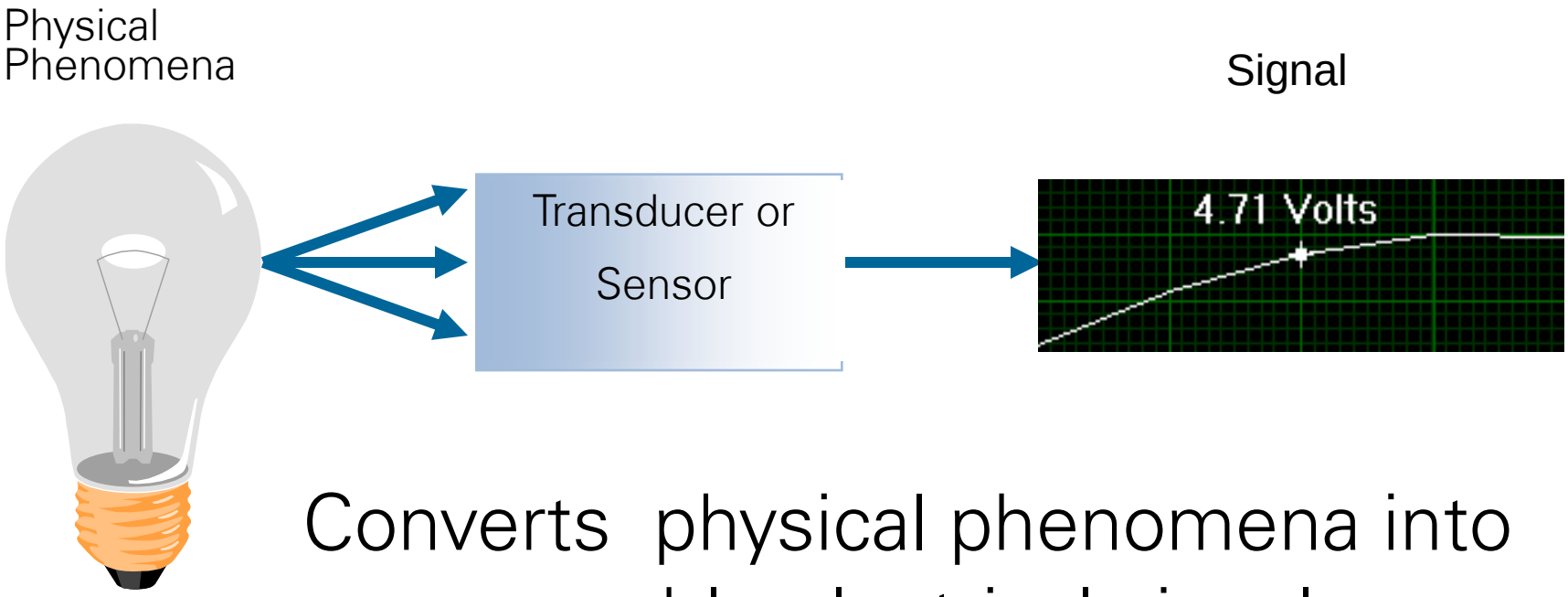
Components of DAQ System



Components of DAQ System



Sensor Overview

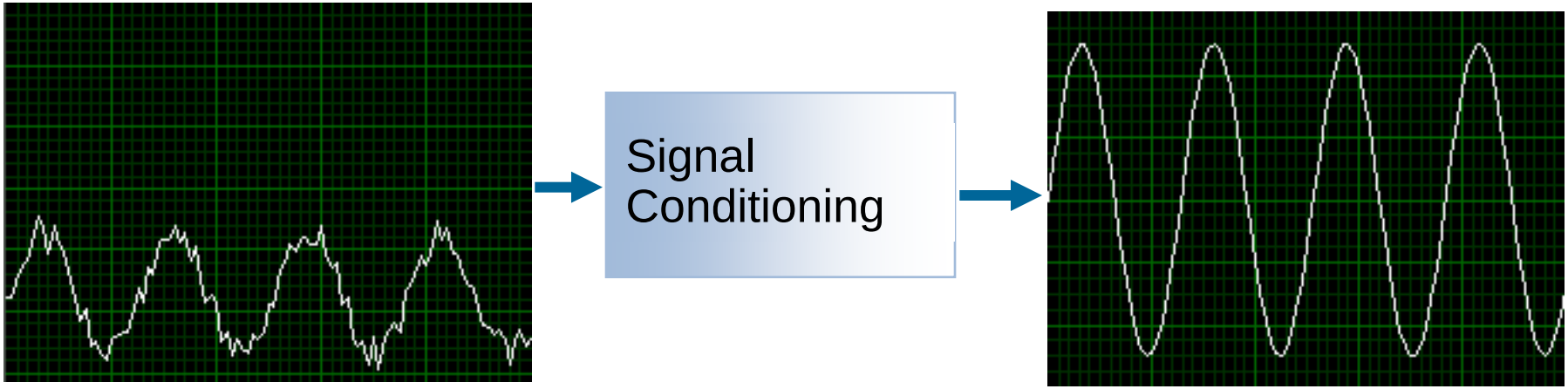


Converts physical phenomena into a measurable electrical signal.

Sensor Examples

Phenomena	Transducer/Sensor
Temperature	Thermocouples Resistive Temperature Devices (RTDs) Thermistors
Light	Vacuum tube Photo sensors
Sound	Microphone
Force and Pressure	Strain gages Piezoelectric transducers
Position and Displacement	Potentiometers Linear voltage differential transformer Optical encoder
Fluid	Head meters Rotational flowmeters
pH	pH electrodes

Signal Conditioning



Noisy, Low-Level Signal

Filtered, Amplified Signal

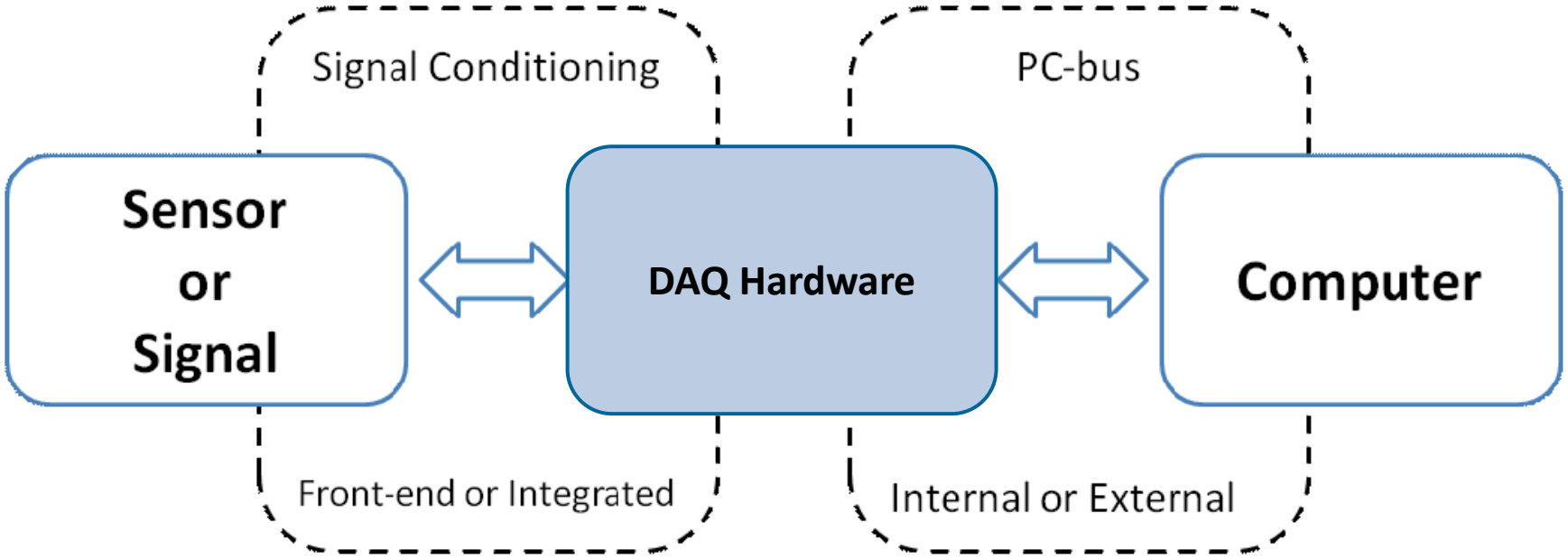
Signal Conditioning improves a signal that is difficult for your DAQ device to measure

Signal Conditioning is not always required

Signal Conditioning Examples

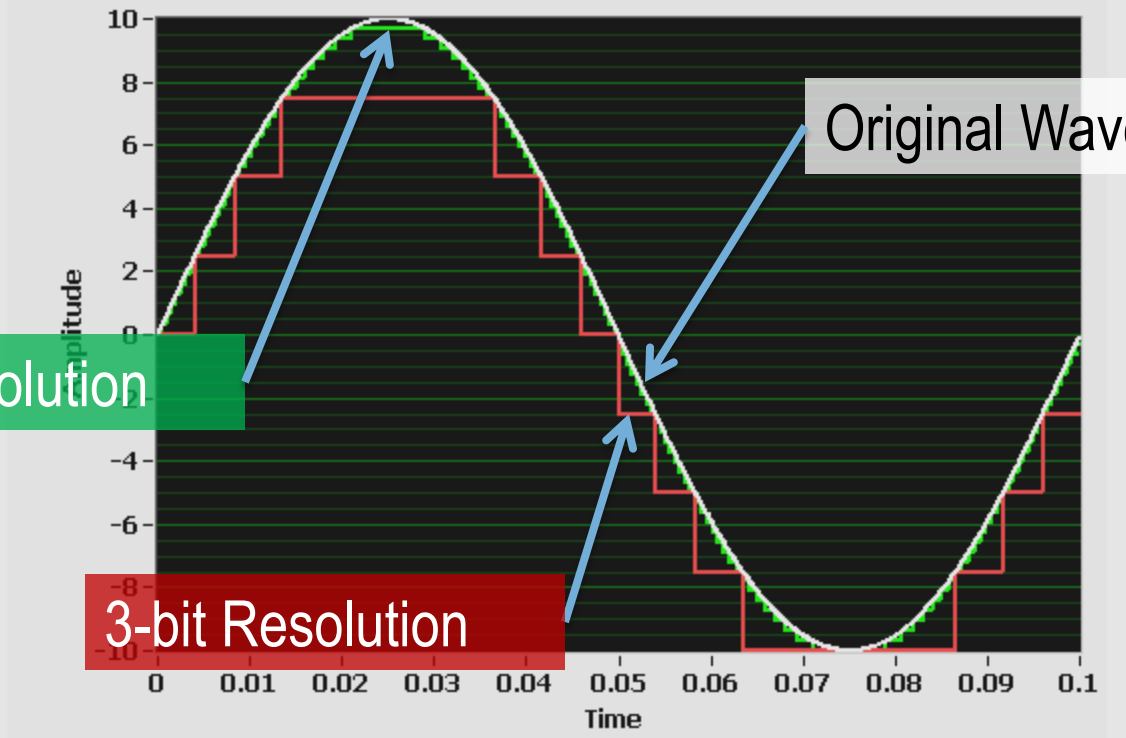
Transducer/Signals	Signal Conditioning
Thermocouples	Amplification, Linearization, Cold-Junction Compensation
RTD (Resistance Temp. Detector)	Current Excitation, Linearization
Strain Gauge	Voltage Excitation, Bridge Configuration, Linearization
Common Mode or High Voltage	Isolation Amplifier
Loads requiring AC Switching or Large Current Flow	Electromechanical Relays or Solid-State Relays
High Frequency Noise	Low-Pass Filters

Components of DAQ System



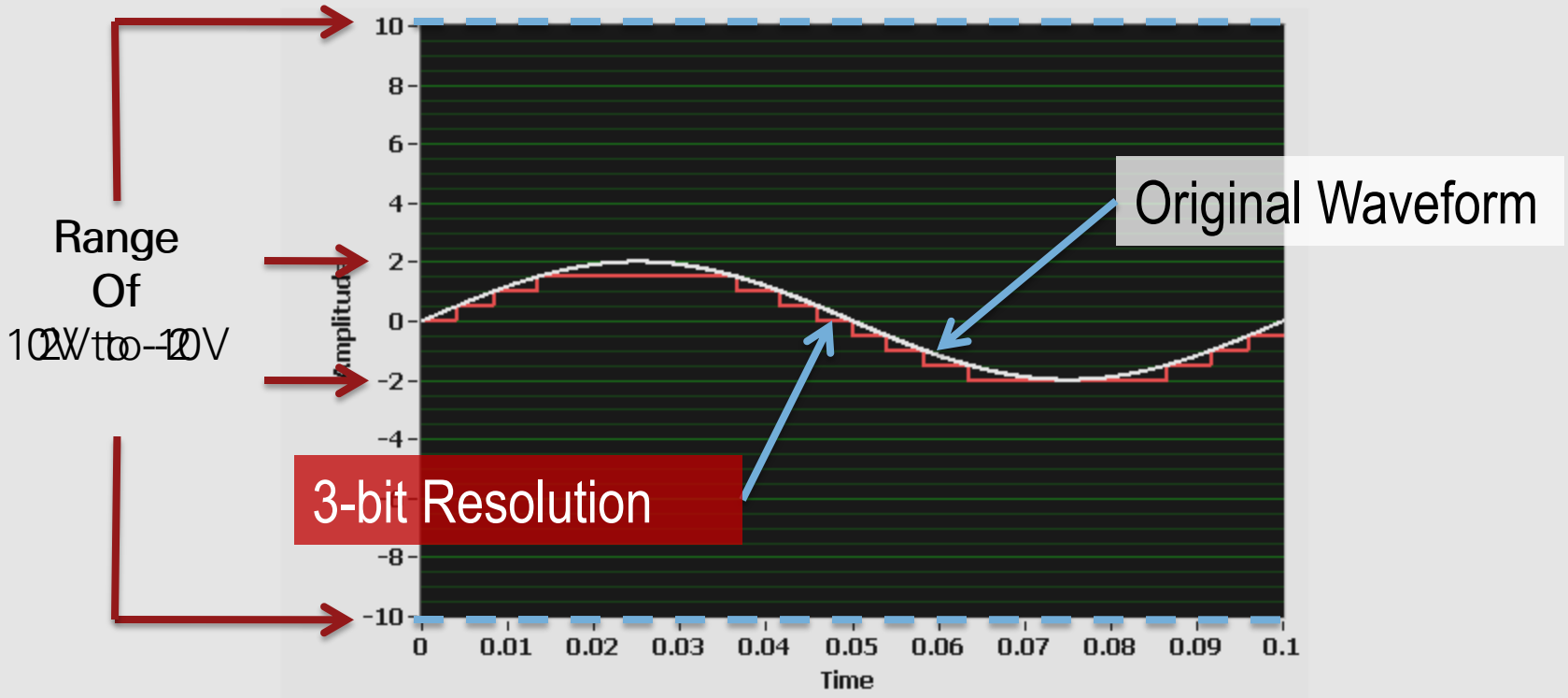
The Three R's of Data Acquisition

Resolution Range Rate



The Three R's of Data Acquisition

Resolution | Range | Rate

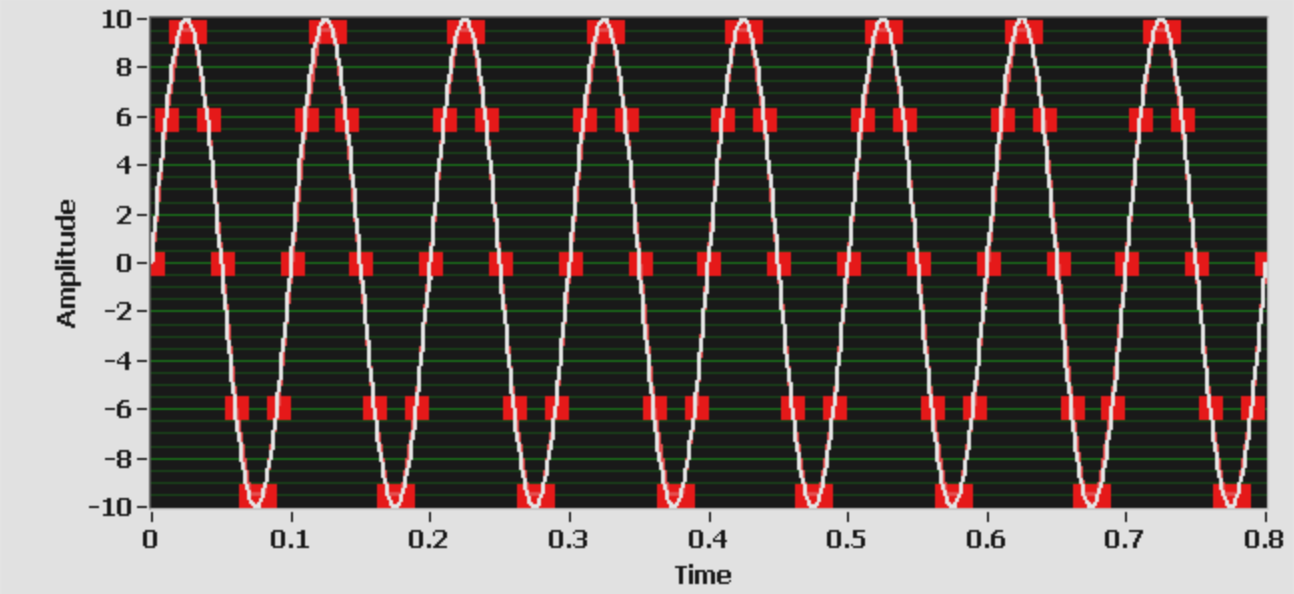


The Three R's of Data Acquisition

Resolution

Range

Rate



Sampling Rate = 100 Hz

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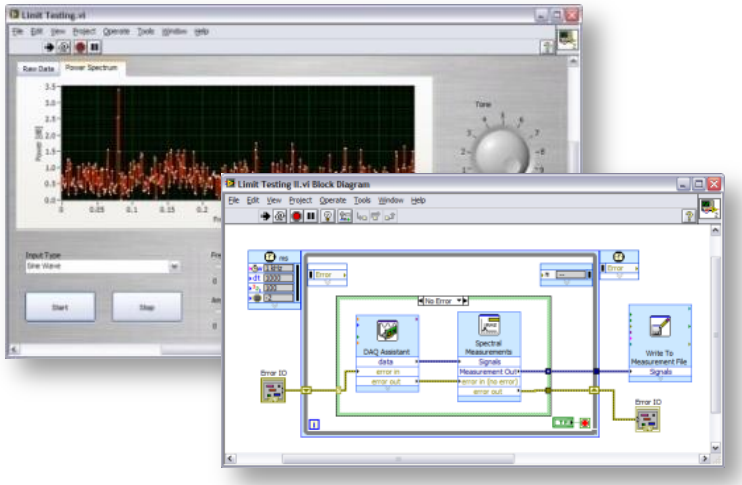
NI DAQ Platforms

Video

Demo

One application, multiple targets



USB

PCI/PCIe

CompactDAQ

PXI/PXIe

Wireless

Oil Wells Vibration Monitoring for Vietsovpetro

Applications: Vietsovpetro wants to drill more oil wells between existing wells to maintain output level when some existing wells are depleted. This system is to monitor the vibration during drilling to alert operator if drilling shaft is about to touch the existing wells. System was developed by NI partner AIC.

VIETSOVPETRO

AIC

http://sine.ni.com/cs/app/doc/p/id/cs-14201

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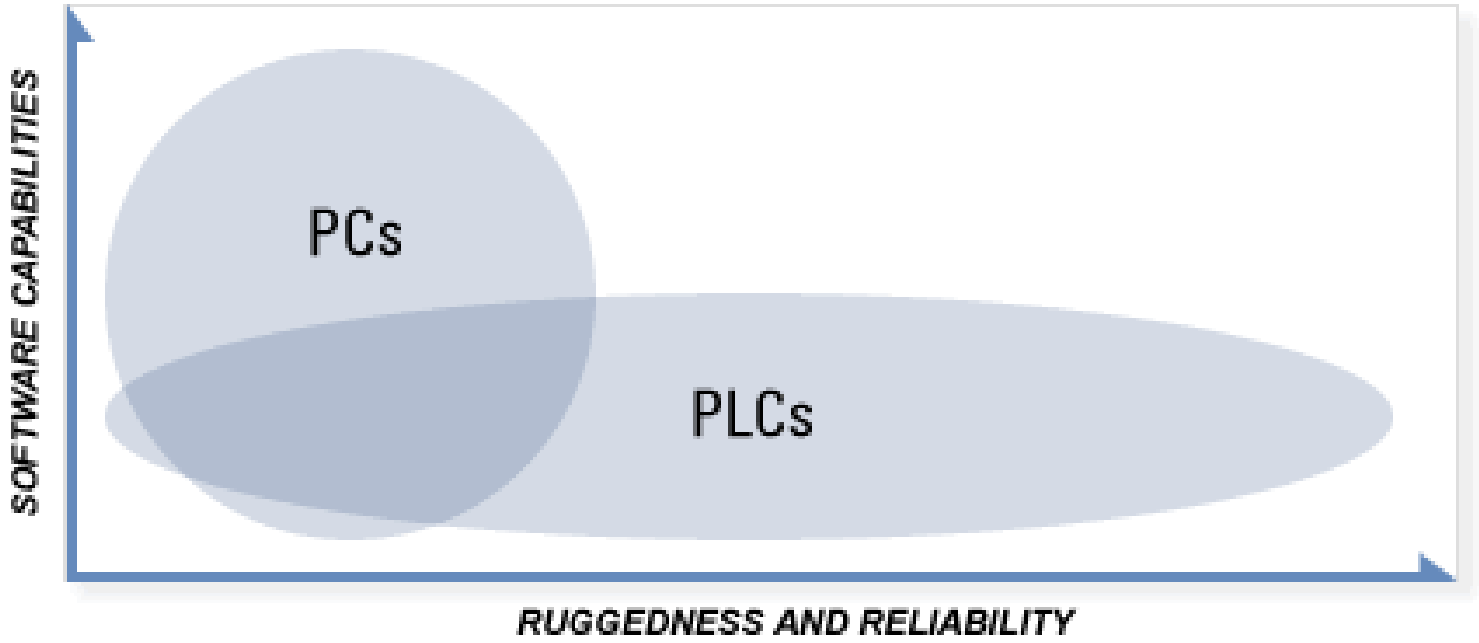
Programmable Automation Controller (PAC)

Ruggedness and reliability of PLC

Software capabilities of PC

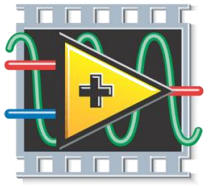
Modular and diverse I/O

Optimized for measurements



Video

NI PACs



LabVIEW
& Real-Time

PXI Industrial Controllers

High speed, high channel density, I/O variety

Compact RIO

High speed, low level customization

NI Smart Cameras

Compact and distributed machine vision

NI Wireless Sensor Network

Long-term wireless measurement

HMIs and Industrial Screens

Add communication to PACs

Video

Introduction to CompactRIO
Embedded Monitoring and Control System

Open Embedded System

- Inline, real-time, data processing
- Customizable data acquisition, control

C Series I/O modules

Rugged

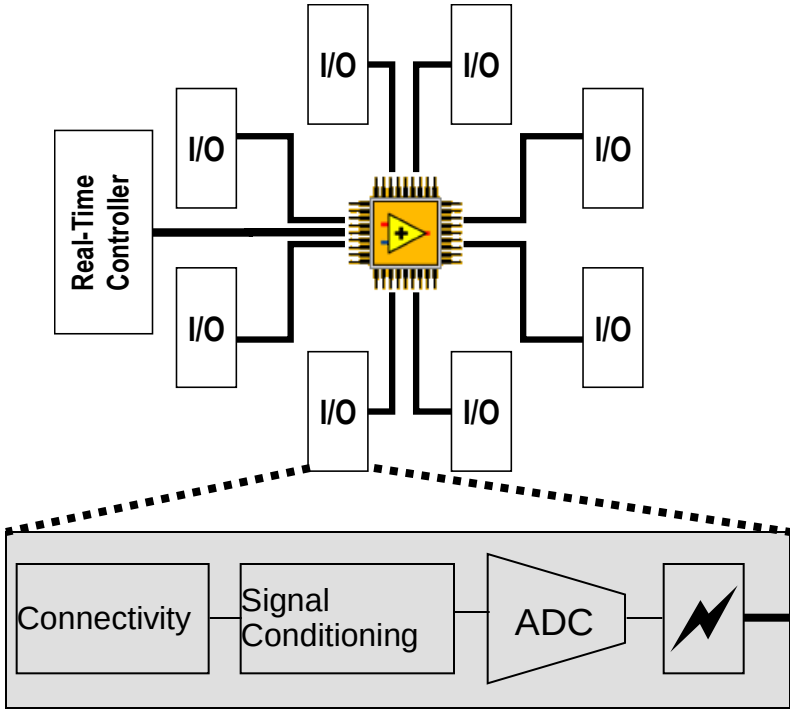
Reliable Standalone Operation

NI CompactRIO Architecture

Real-Time Processor

Reconfigurable FPGA

Industrial I/O Modules



- Industrial I/O Modules with built-in signal conditioning for direct connection to industrial sensors/actuators
- Reconfigurable FPGA for high-speed and custom I/O timing, triggering, control
- Real-Time Processor for deterministic, stand-alone operation and advanced analysis

CompactRIO Connectivity

More than 100 modules and growing!

CompactRIO

Ethernet TCP/IP
FTP Server
Web Server
USB Storage
RS-232/RS-485

Analog Camera Interface*

CAN

GPS

GSM/GPRS*

3G

ZigBee*

RS-232
RS-485
PROFIBUS

Removable SD Memory Cards

Sensors & Actuators (Analog and Digital I/O)

Motion Control / Motor Drive

* 3rd party module examples

Over 100 C Series I/O Modules

Demo

Analog Input
- Up to 1MS/s, simultaneous sampling
- 4, 8, 16, and 32-ch options
- Built-in signal condition for sensors
  - Strain gages, accelerometers, thermocouples, RTDs
- Up to ± 300 VRMS, ±5ARMS
- 12, 16 and 24-bit resolution
- Available ch-to-ch isolation

Analog Output
- Up to100 kS/s simultaneous updating
- Up to 16-ch per module
- 10 V, ±20 mA
- Isolation

- **Digital I/O**
  - Up to 10 MHz timing
  - Counter/timer, PWM
  - 8 and 32-channel options
  - 5V/TTL, 12/24/48/60 V logic levels
- **Specialty**
  - 2-port CAN modules
  - Brushed DC servo motor drive
- **Third Party Modules**
  - LIN, Profibus, WLAN, MIL-1553, ARINC-429, GPS, and more

LabVIEW Robotics

Connectivity to sensors and actuators from top vendors

Image processing and acquisition libraries

JAUS, I2C, SPI, and Ethernet protocols for communication

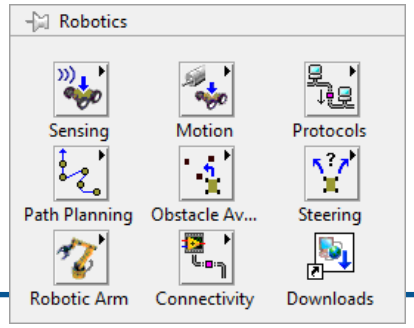
Deployment to embedded real-time and FPGA hardware

Algorithms for navigation and path planning

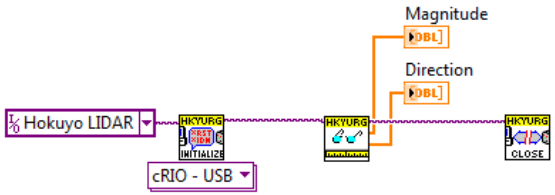
Steering and kinematics algorithms

LabVIEW Robotics

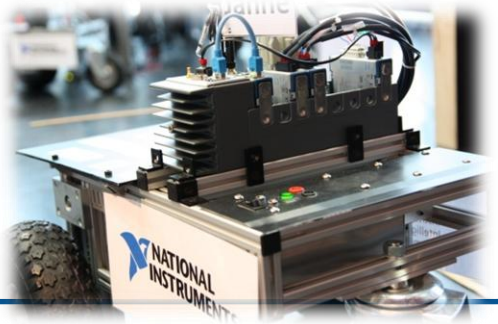
IP for sensing, navigation, motion control and more



High-level **graphical programming** environment

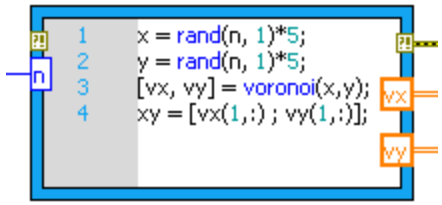


Deployment to Real-Time and FPGA hardware

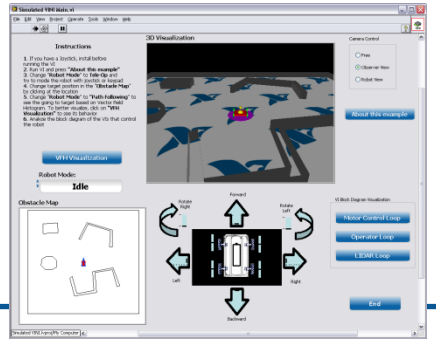


Connectivity to sensors and actuators from top vendors

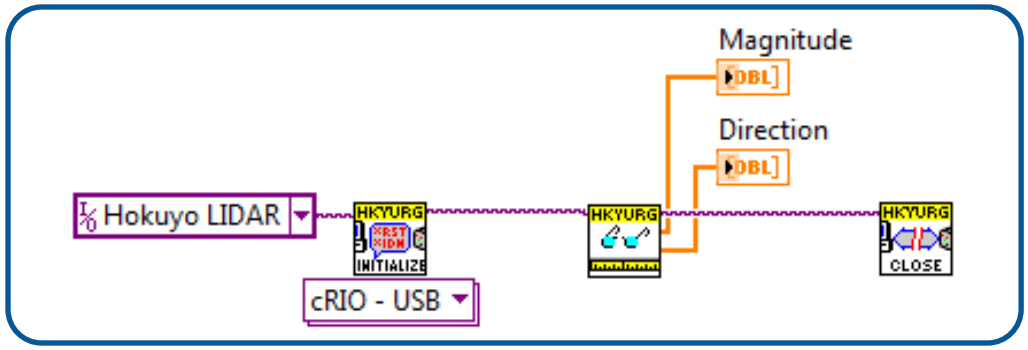
Tools for integrating **text-based algorithms**



Examples of real-world applications



LabVIEW Robotics

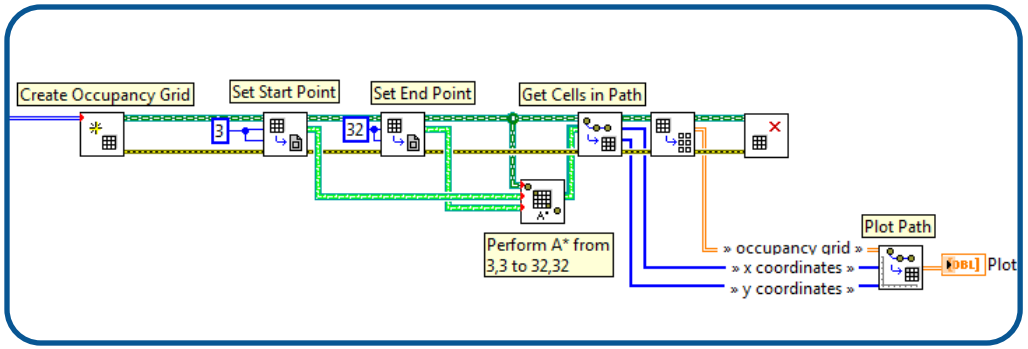


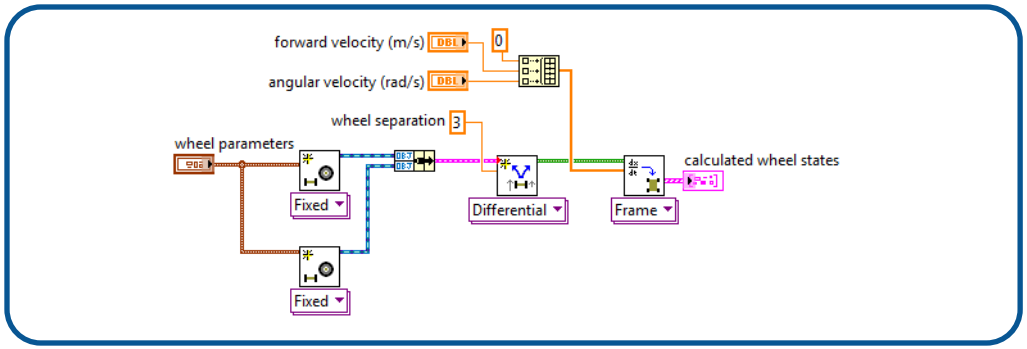
Sense

Quickly retrieve data from popular robotics sensors such as LIDAR, GPS, IMU, compass, infrared, cameras, thermal, light, sonar and encoders

Think

Utilize building blocks for common navigation and path planning algorithms such as Voronoi, Vector Field Histogram (VFH), A* and AD*





Act

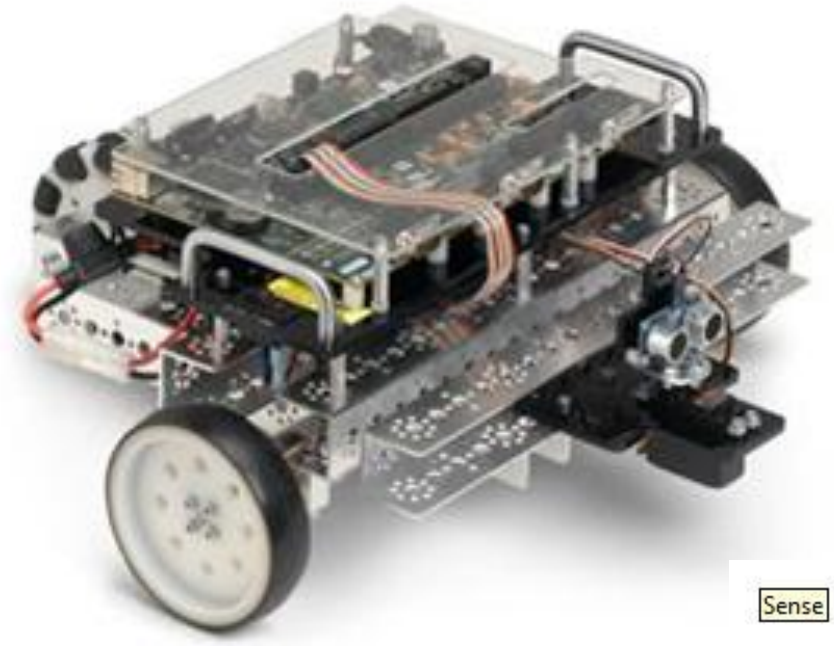
Control mobile robots with steering functions and robotic arms with kinematics functions. Connect to a variety of motors using built-in drivers.

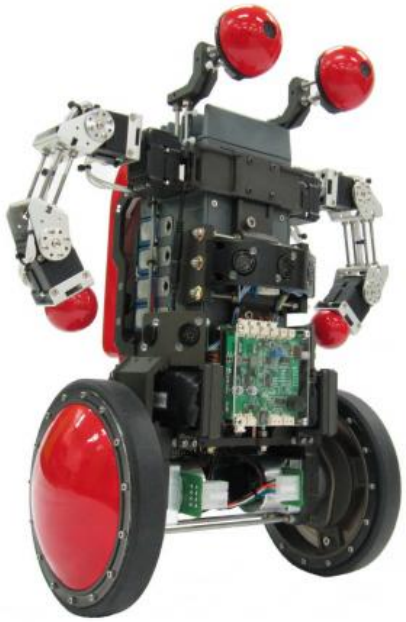
NATIONAL INSTRUMENTS

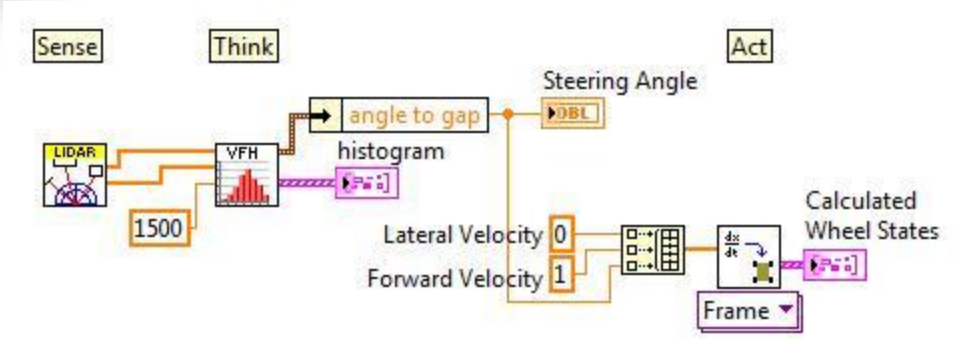
ni.com/robotics

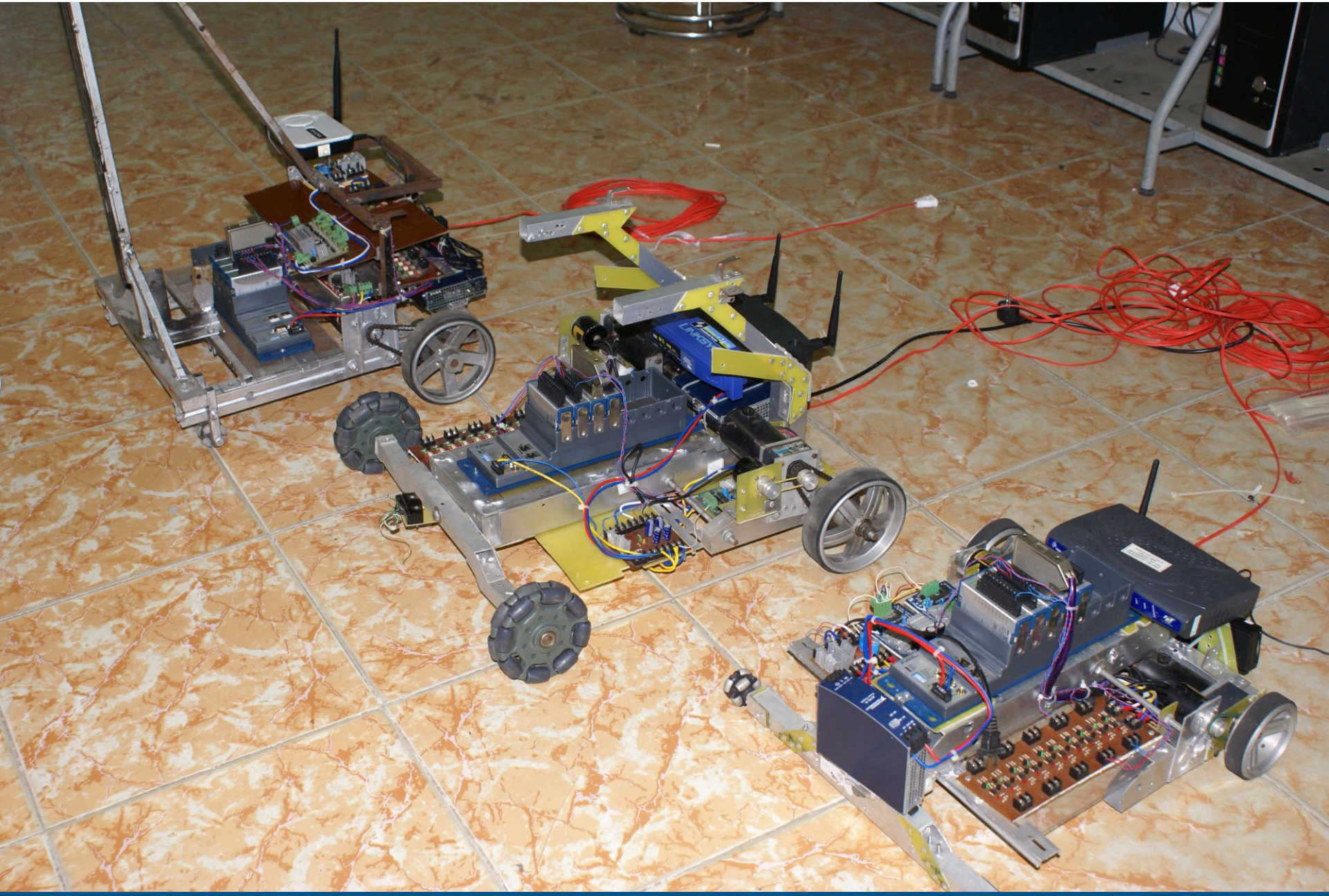
Video Video

NI LabVIEW Robotics Starter Kit (DaNI) for Education








LINKSYS

Video

High-Performance Smart Cameras

Demo

Includes Vision Builder software

Real-Time Operating System

Intel Atom (x86) processor

512MB DDR2 RAM

Direct Drive Lighting

Heat Sink For power dissipation

Industry standard mounting holes

IP67 Rating (water-proof, dust-proof)

Power & I/O
4 inputs
4 outputs
1 dedicated trigger

Lens cover

M12 Connectors

RS-485 (gigabit ethernet)

USB & VGA

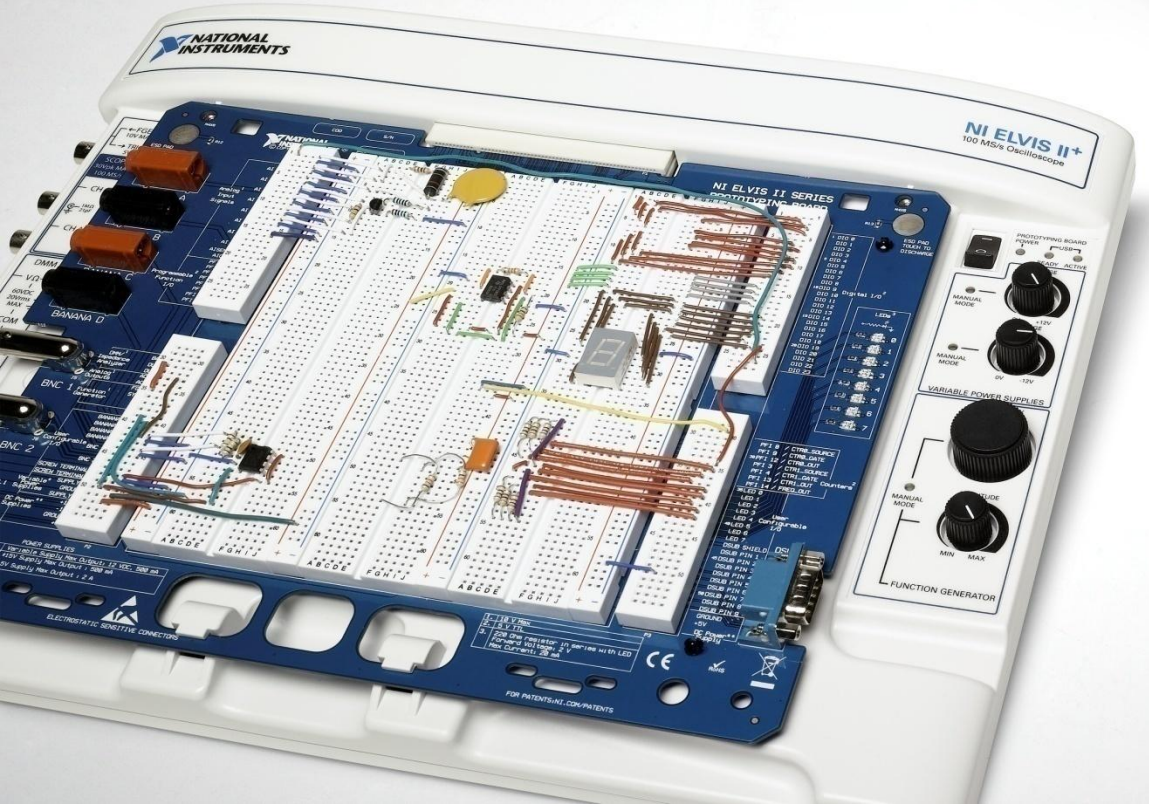
Agenda

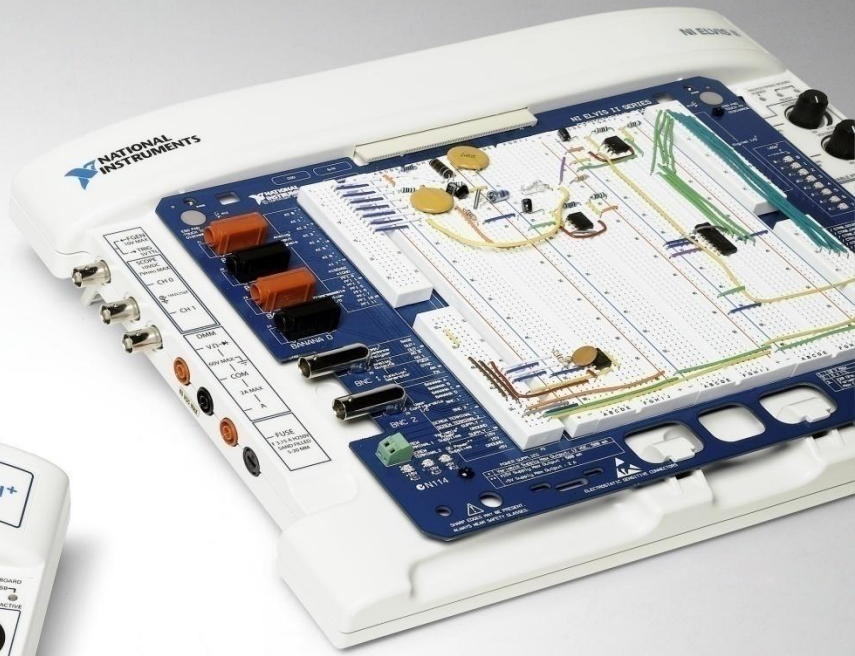
- Overview of National Instruments
- LabVIEW and Its Applications
- PC-based Measurement and Control Technologies
- **NI Platforms for Teaching and Research**
- Conclusions

NATIONAL INSTRUMENTS™

NI ELVIS

Multidisciplinary Teaching & Engineering Platform





NATIONAL INSTRUMENTS

NI ELVIS II | Hardware Specifications

Oscilloscope

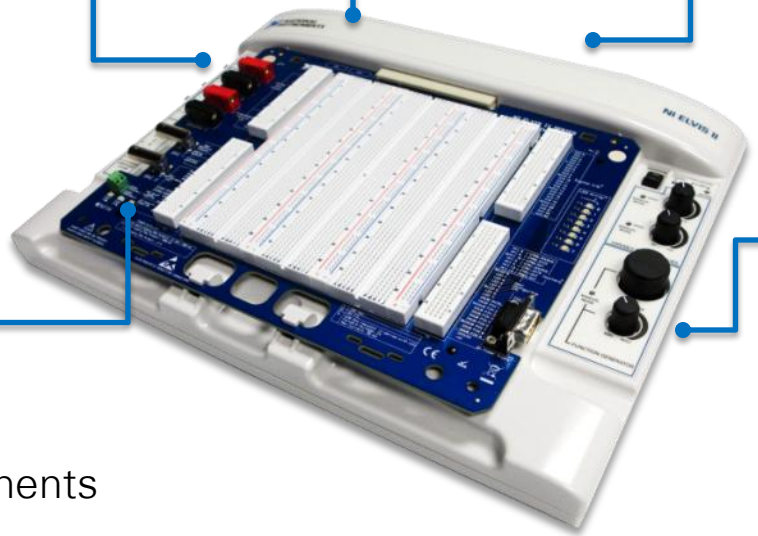
- 16-bit resolution
- 1.25 MS/s single channel, 500kS/s two channel aggregate
- 1 to 1.5 MHz Bandwidth
- 1x and 10x probe
- ±10 V input range
- AC/DC coupling

Internal Circuit Protection

- Resettable fuses

USB Connectivity

- Plug-and-play capability
- USB 2.0 Connection



Digital Multimeter

- Isolated measurements
- 5½ digit resolution
- 60 VDC, 20Vrms, 2 ADC, 2 Arms, 100MΩ

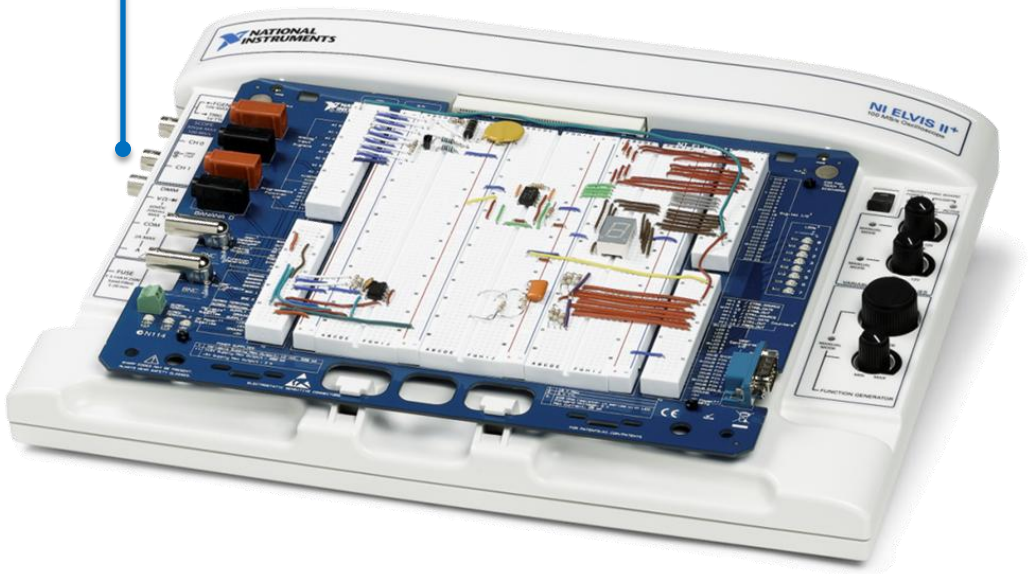
Function Generator

- 10 bit, ±5V range
- 0.2 Hz to 5 MHz Sine
- 0.2 Hz to 1 MHz Triangle/Square
- Software or manual control
- BNC or prototyping board connection

NI ELVIS II+ Hardware | Oscilloscope

Oscilloscope

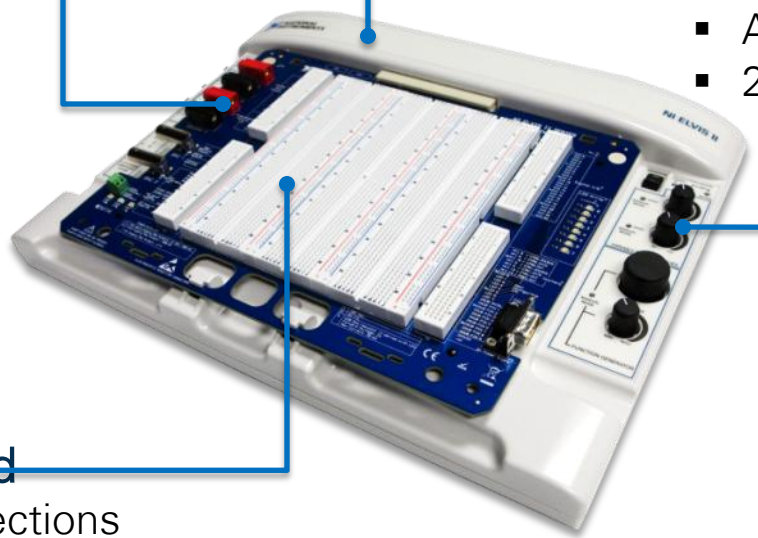
- 100MS/s Sampling Rate
- 50MHz Bandwidth(-3dB)
- 8-bit resolution
- ±20 V max. input range
- AC/DC/GND coupling
- 20MHz Optional Noise Filter
- 1x and 10x probes
- BNC connection



NI ELVIS II | Hardware Specifications

Impedance Analyzer
- 0.2 Hz to 35 kHz Range
- NPN, PNP, Diode

Other Analyzers:
- Bode Analyzer
- 2-wire Current Voltage Analyzer
- 3-Wire Current Voltage Analyzer



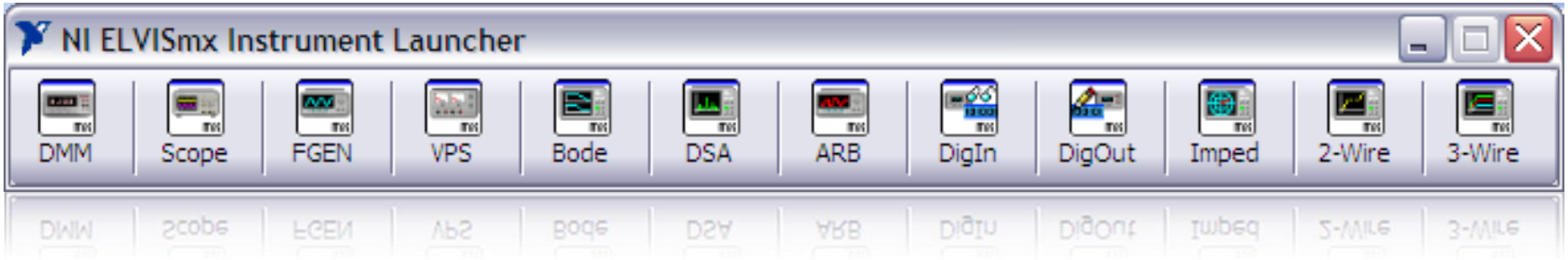
Integrated DAQ
- AI sampling rate 1.25 MS/s single channel, 500kS/s two channel
- 16-bit resolution
- AO 2.8 MS/s update rate
- 24 DIO lines,15 PFI, 2 CTR

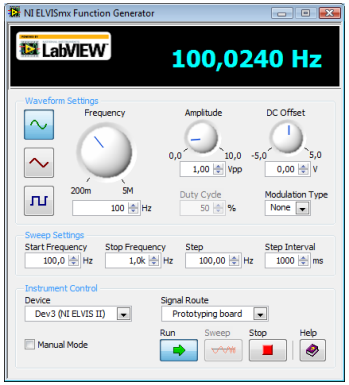
Prototyping Board
- Updated connections
- Detachable
- User-defined Banana Plugs, BNC, D-Sub connectors

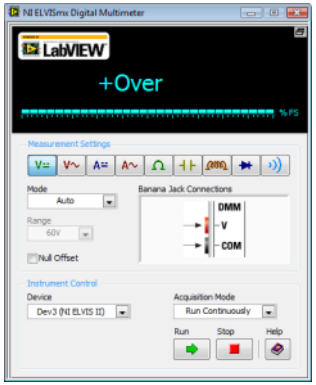
Variable Power Supply
- 10-bit resolution
- 0 to +12V, 0 to -12V
- 500 mA current range

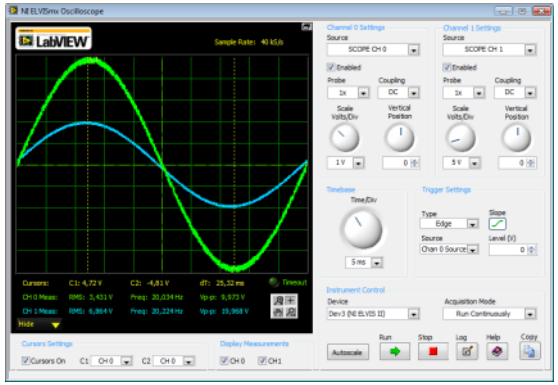
NI ELVISmx Driver | Software Specifications

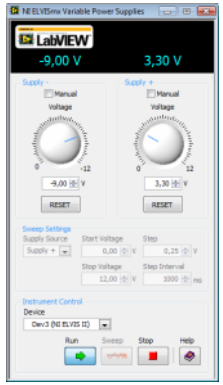
- Ready-to-use instruments – Soft Front Panels
- Customizable instruments





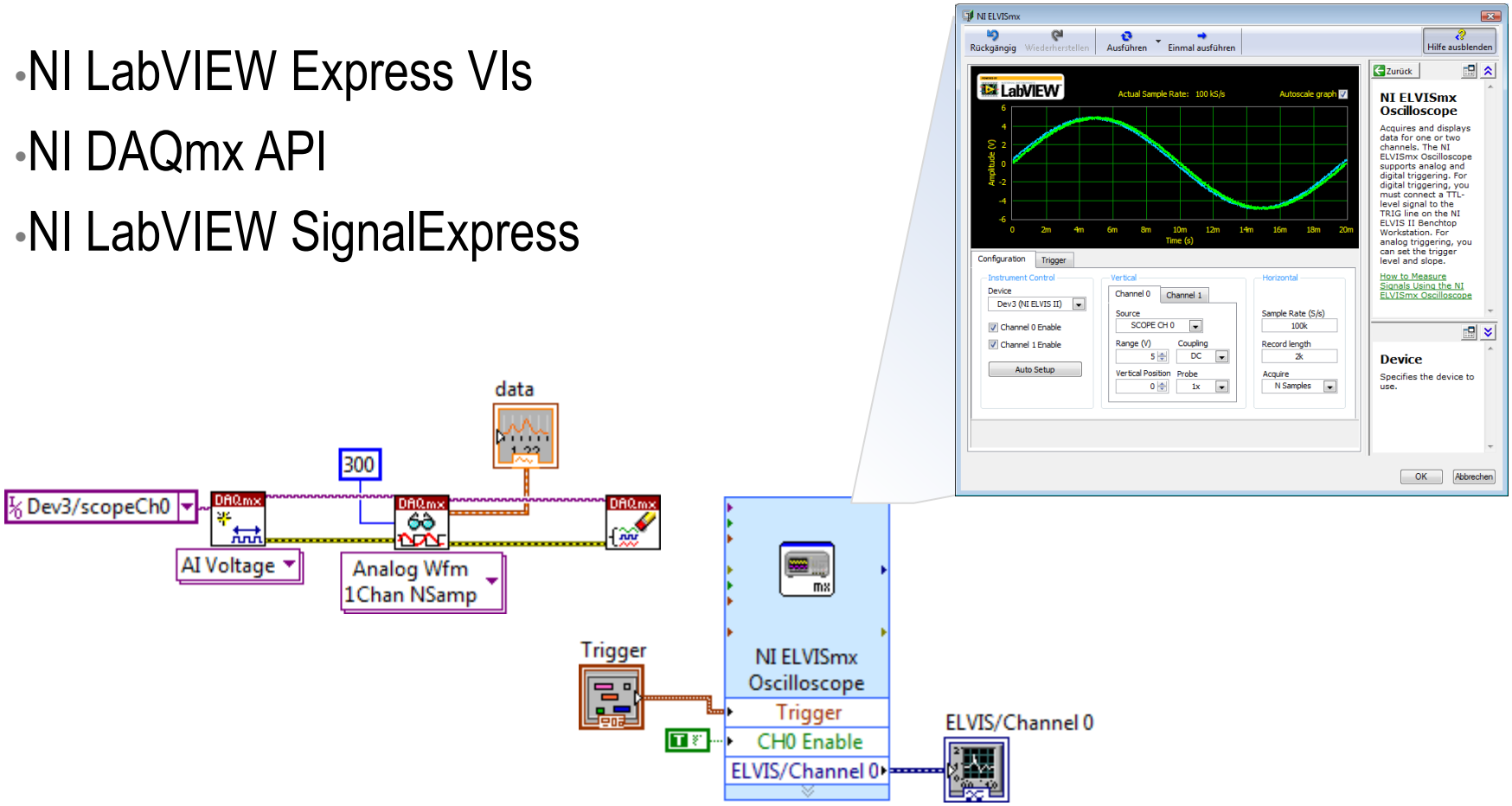






NI ELVISmx Driver | Software Specifications

- NI LabVIEW Express VIs
- NI DAQmx API
- NI LabVIEW SignalExpress



Controls and Mechatronics

QUANSER
INNOVATE. EDUCATE.

Telecommunications

EMONA tims

NATIONAL INSTRUMENTS

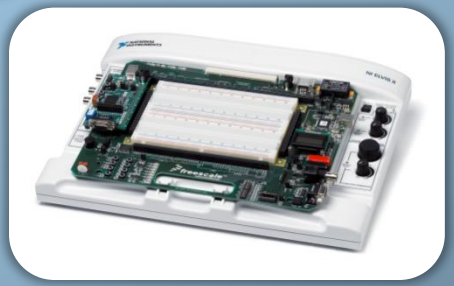
NI ELVIS Platform

Circuits and Measurements

NATIONAL INSTRUMENTS
XILINX

Digital Electronics

freescale™ semiconductor



Embedded Design

Teaching | Measurements

Vernier

Measure. Analyze. Learn.™

Analog Protoboard connector

Digital Protoboard connector

more than 50 sensors

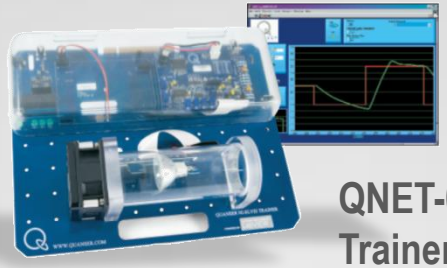
- Hand Dynamometer
- Heart Rate Monitor
- pH sensor
- and more…

Program with NI LabVIEW

NI ELVIS | Controls & Mechatronics Plants

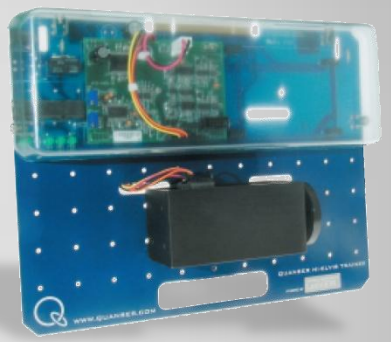
Demo

QNET-011 Rotary Inverted Pendulum



QNET-012 HVAC Trainer

QNET-010 DC Motor Control Trainer



QUANSER
INNOVATE. EDUCATE.

NATIONAL INSTRUMENTS LabVIEW

NEW! QNET-013 VTOL 1DOF Helicopter Plant

NEW! QNET-014 Mechatronics Sensors 1 Board

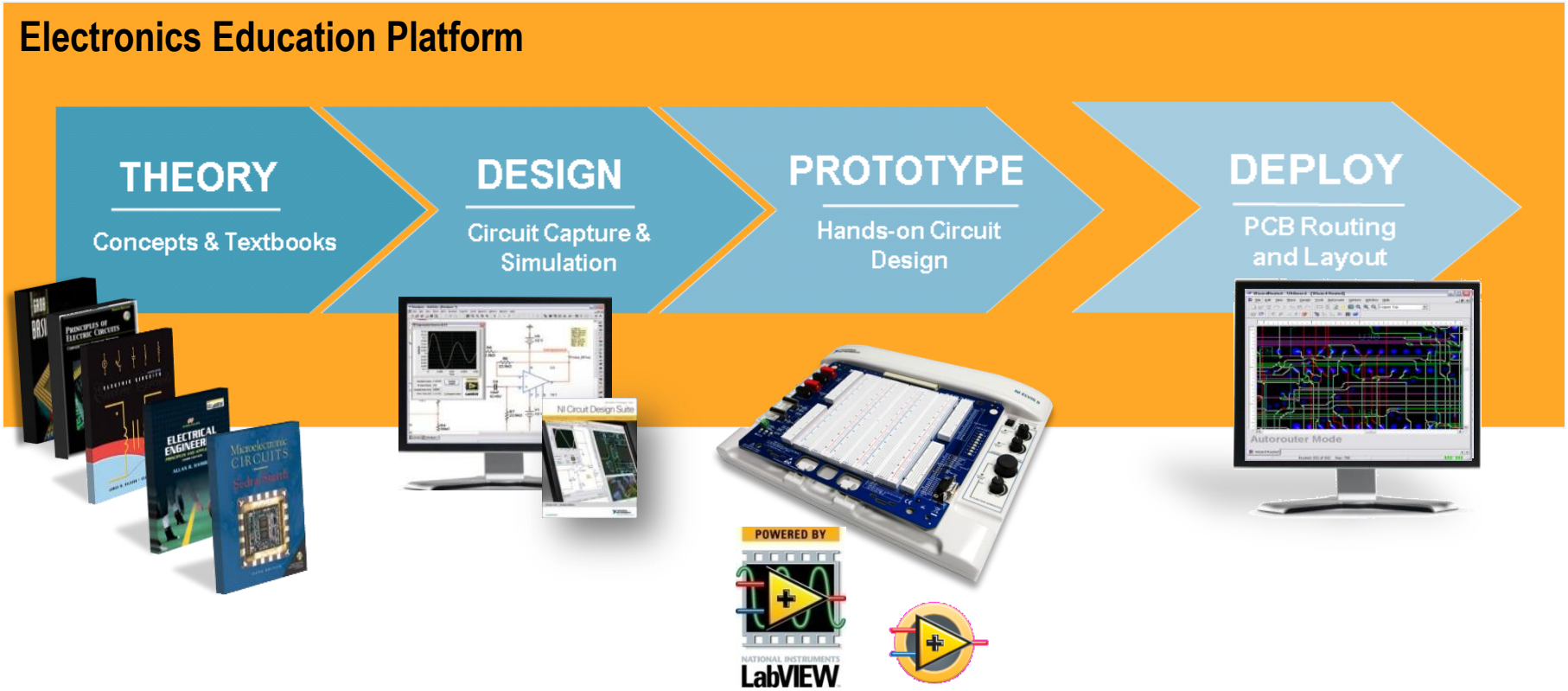
NATIONAL INSTRUMENTS

NI ELVIS | Circuits

National Instruments Electronics Education Platform

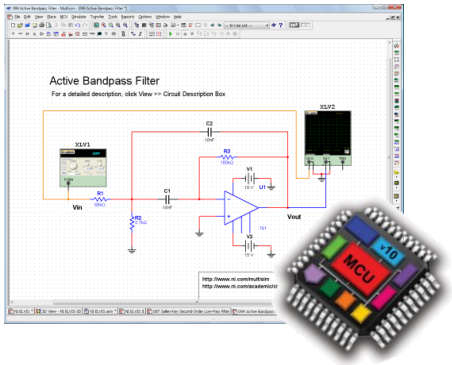
- NI ELVIS
- NI Multisim
- NI LabVIEW

NI Electronics Education Platform

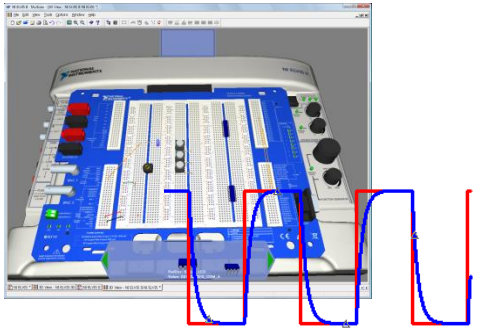


Teaching | Circuit Design Flow

Demo

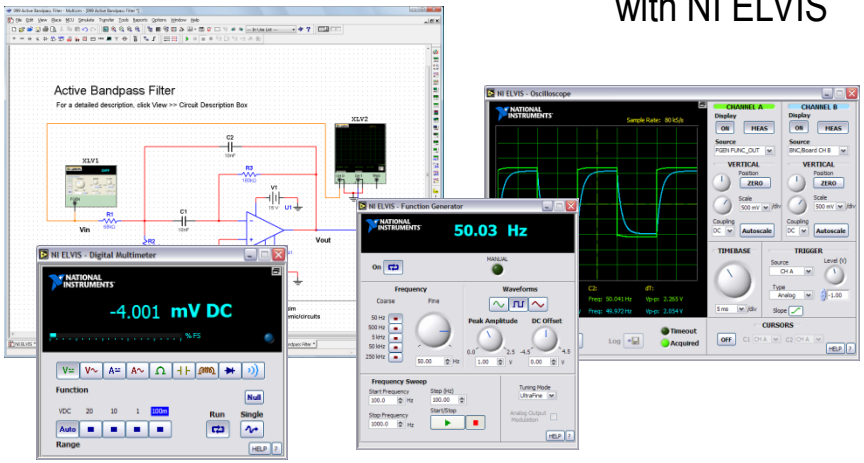


Step 1: Capture, Simulate and improve a design in NI Multisim

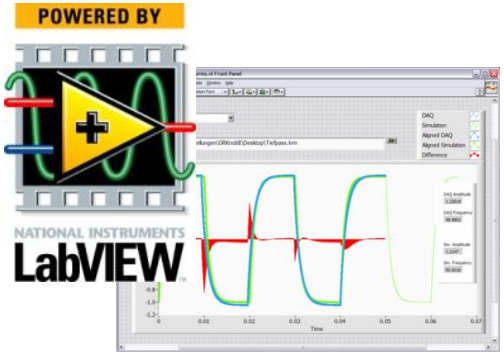


Step 2: Pre-lab in 3D breadboarding environment

Step 3: Build circuit and make measurement with NI ELVIS


Active Bandpass Filter
For a detailed description, click View >> Circuit Description Box
NI ELVIS - Digital Multimeter
-4.001 mV DC
NI ELVIS - Function Generator
50.03 Hz
NI ELVIS - Oscilloscope

Step 4. Compare *simulated* data and *real* measurements



Step 5: Customization and complex analysis with LabVIEW

NI ELVIS | Digital Electronics FPGA

NATIONAL INSTRUMENTS

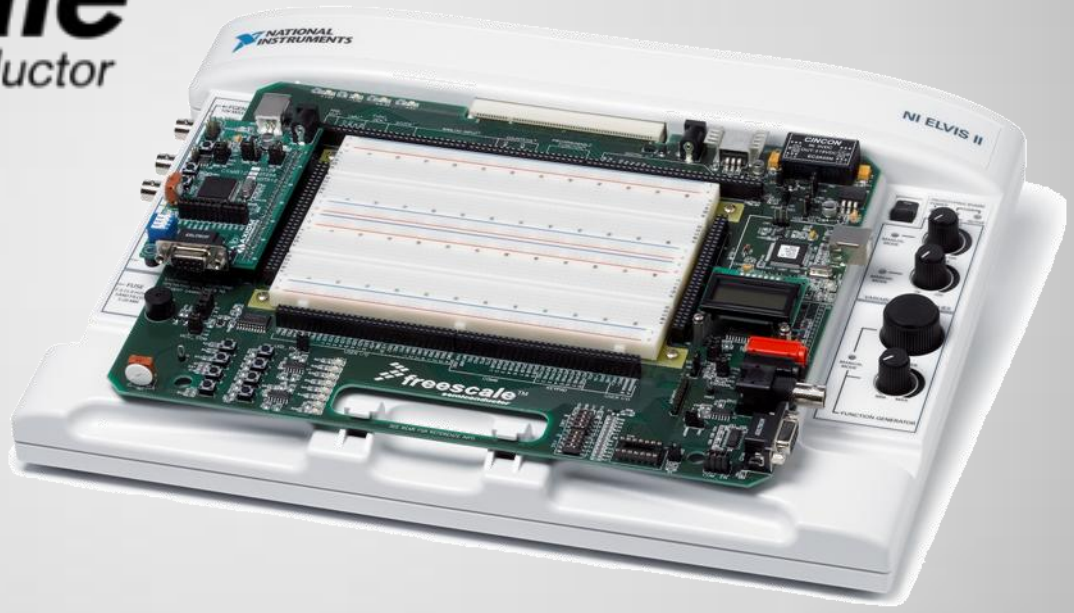
NATIONAL INSTRUMENTS LabVIEW

National Instruments
Digital Electronics FPGA

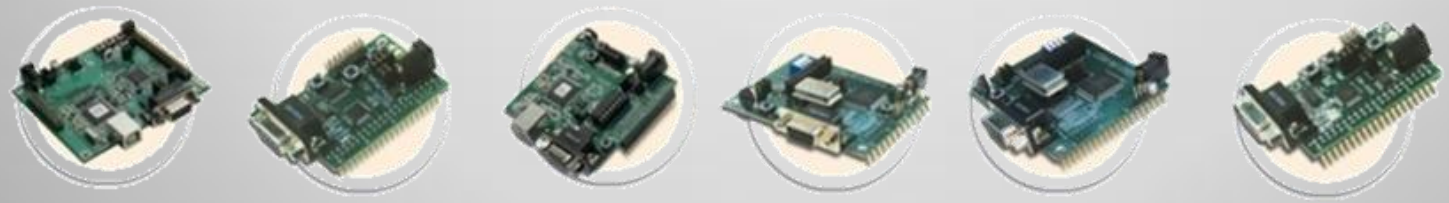
NI ELVIS | Embedded MCU

freescale™ semiconductor

NATIONAL INSTRUMENTS LabVIEW



Freescale HCS12
SLK



NI ELVIS | Telecommunications & Fiber Optics

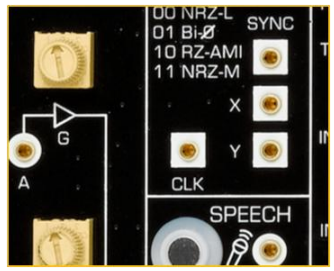
Emona FOTEx ETT-203

Emona DATEx ETT-202

DATEx | Telecommunication

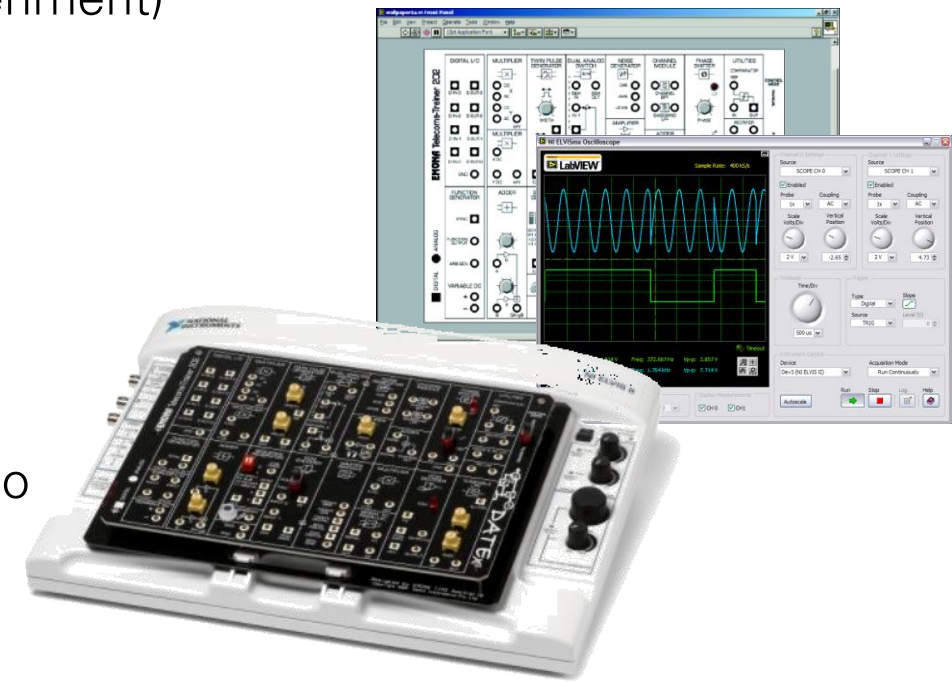
Telecommunications Trainer Board

- LabVIEW Soft Front Panels
- Based on Block Diagram modeling
- Courseware Included (30 Experiment)

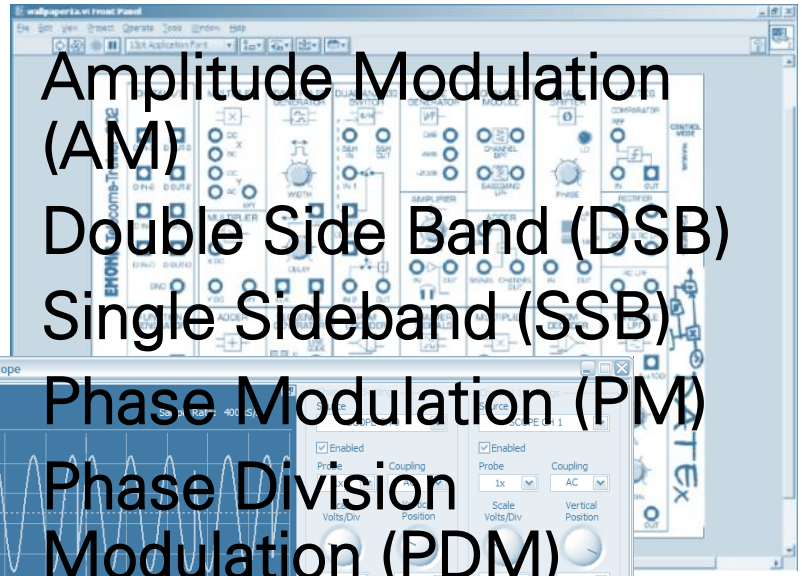


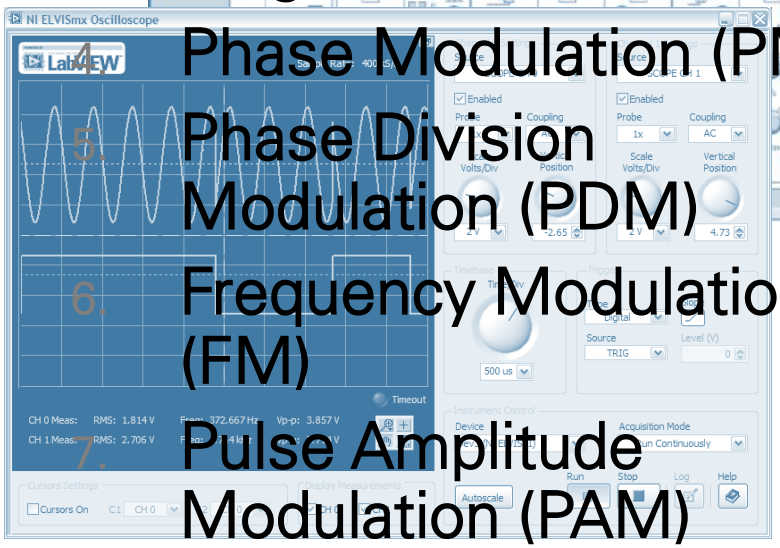
Example Labs

- AM, DSB & FM
- BPSK, QPSK, QAM
- FSK, ASK, Sampling
- PCM & Line Codes
- Intro to Software Defined Radio

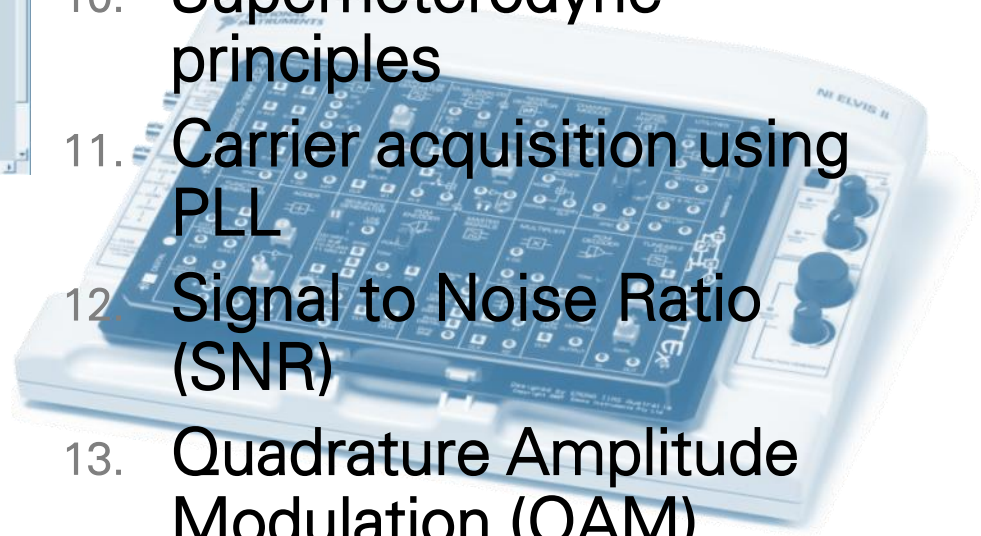


Analog Communications Labs

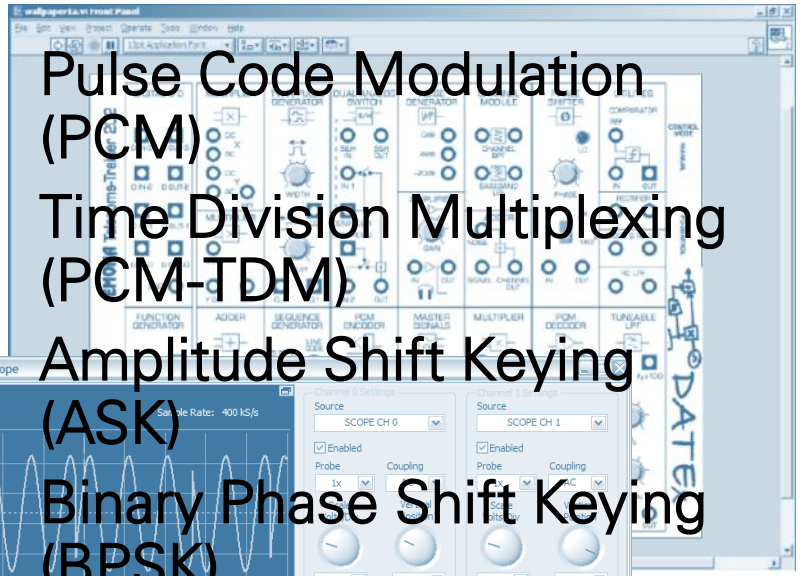




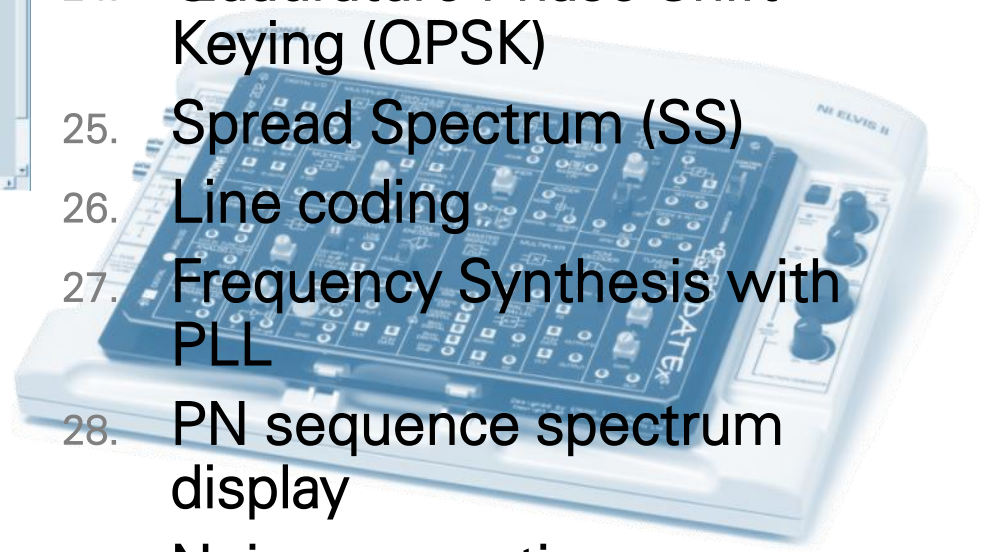
1. Amplitude Modulation (AM)
2. Double Side Band (DSB)
3. Single Sideband (SSB)
4. Phase Modulation (PM)
5. Phase Division Modulation (PDM)
6. Frequency Modulation (FM)
7. Pulse Amplitude Modulation (PAM)
8. Pulse Width Modulation (PWM)
9. Speech and audio messages
10. Superheterodyne principles
11. Carrier acquisition using PLL
12. Signal to Noise Ratio (SNR)
13. Quadrature Amplitude Modulation (QAM)



Digital Communications Labs

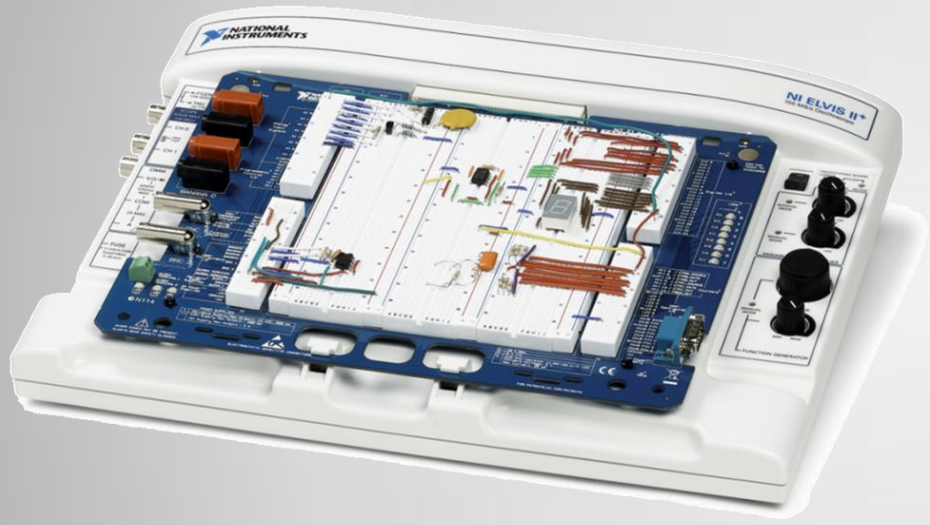


14. Pulse Code Modulation (PCM)
15. Time Division Multiplexing (PCM-TDM)
16. Amplitude Shift Keying (ASK)
17. Binary Phase Shift Keying (BPSK)
18. Frequency Shift Keying (FSK)
19. Introduction to GFSK
20. Pulse shaping
21. Data recovery
22. Inter-Symbol Interference (ISI)
23. Differential Phase Shift Keying (DPSK)
24. Quadrature Phase Shift Keying (QPSK)
25. Spread Spectrum (SS)
26. Line coding
27. Frequency Synthesis with PLL
28. PN sequence spectrum display
29. Noise generation



NI ELVIS Platform for Hands-On Learning

NATIONAL INSTRUMENTS LabVIEW



- 12 Integrated Instruments
- Programmable with LabVIEW
- USB-Plug & Play
- Small form factor
- Expandable with plug-in modules

Circuits

Digital Electronics

Controls

Telecommunication

Embedded

NI myDAQ | Do Engineering: Anywhere, Anytime

ni.com/mydaq

NI myDAQ Features

Plug & Play Instruments

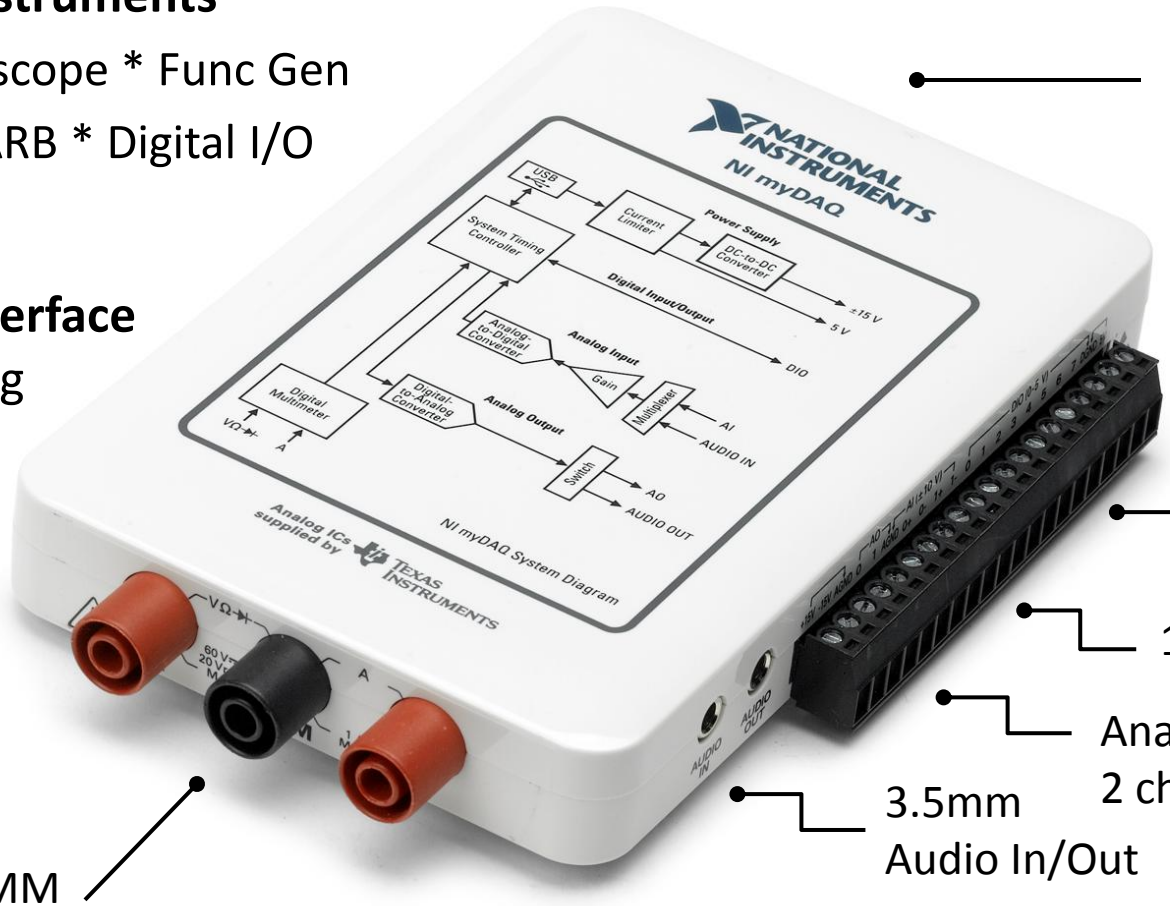
DMM * Oscilloscope * Func Gen

Bode * DSA * ARB * Digital I/O

Computer Interface

LabVIEW using

NI DAQmx



USB Bus Powered

±15 V and 5V

8 DIO

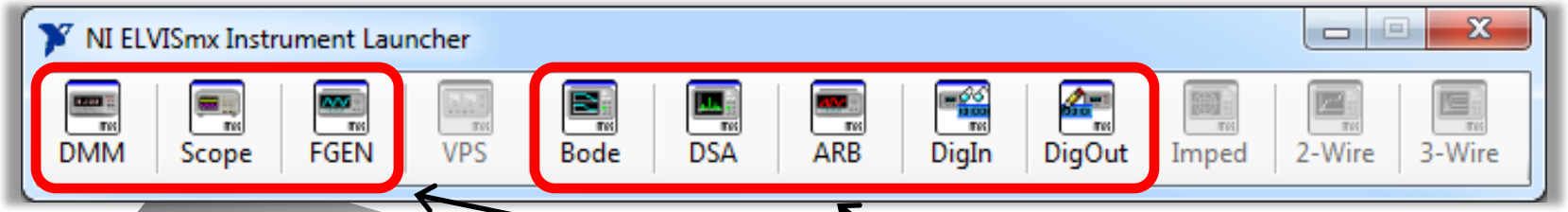
1 Counter

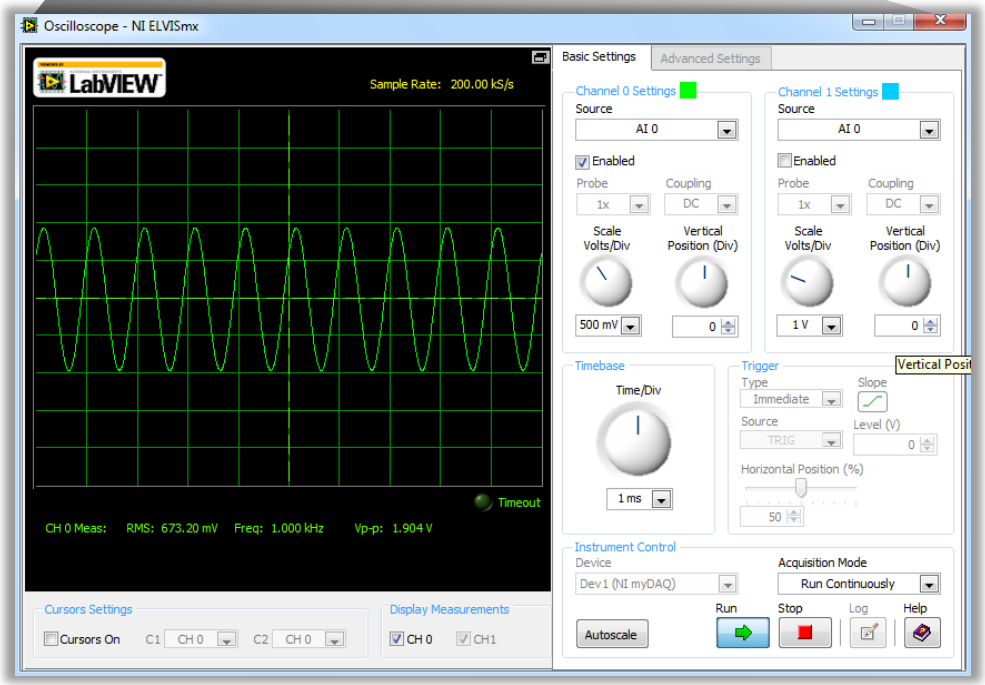
Analog In/Out
2 ch, 200ks/s

3.5mm
Audio In/Out

Integrated DMM
V, I, Ω, Diode

NI ELVISmx Instruments for myDAQ



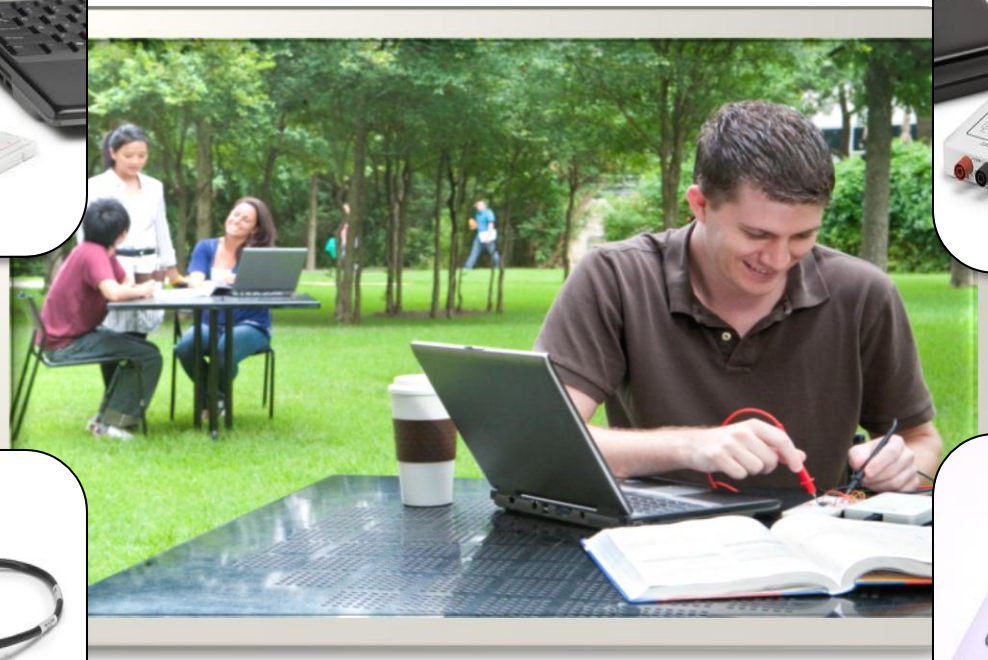


Supported Instruments

- DMM
- Oscilloscope
- Function Generator
- Bode Analyzer
- Dynamic Signal Analyzer
- Arbitrary Waveform Generator
- Digital Reader
- Digital Writer

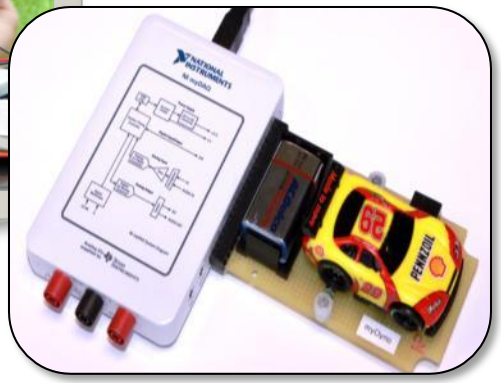
Circuits

Signal Processing



Measurements

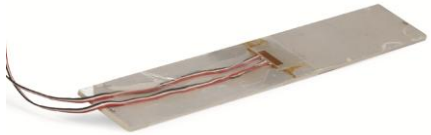
Controls



Interfacing the Real World

Sensors

Temperature



Strain

Acceleration

Sound

Actuators

DC Motor Control*

Micro Relays*

LEDs

And more…

*Driving high current requires an external DC power source and transistor circuit.

NI USRP

Tunable RF Transceiver Front Ends

- Frequency Range
  50 MHz – 2.2 GHz (NI-2920)
  2.4 GHz & 5.5 GHz (NI-2921)

Signal Processing and Synthesis

- NI LabVIEW to develop and explore algorithms
- NI Modulation Toolkit and LabVIEW add-ons to simulate or process live signals

Applications

- FM Radio
- TV
- GPS
- GSM
- ZigBee
- Safety Radio
- OFDM
- Passive Radar
- Dynamic Spectrum Access

1 Gigabit Ethernet Connectivity

- Plug-and-play capability
- Up to 25 MS/s baseband IQ streaming

Demo

Digital Communications Bundle

Bundle Contents

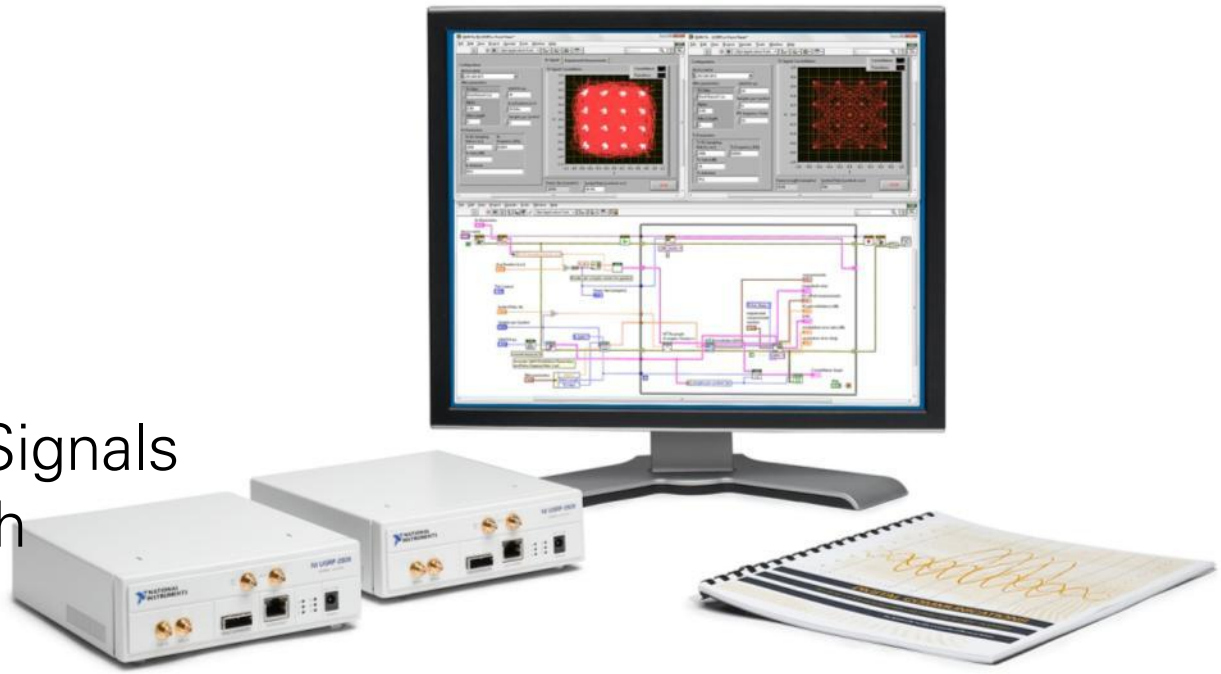
- Two NI USRP-2920 + Toolkits
- MIMO Cable
- Digital Comm Lab Manual

Target Courses

- Communication Systems
- Digital Communications

Key Benefits

- Affordable
- Accessible
- NI Supported
- TX & RX Real RF Signals
- Scales to Research



Lab Ready| Packet Radio & OFDM

Digital Communications Labs

by Dr. Robert Heath, UT Austin

1 AWGN Simulator
2.1 Modulation /Demodulation
2.2 Pulse Shaping
3 Energy Detection
4 Equalization
5 Frame Detection
6 Intro to OFDM
7 Frequency Correction & Sync
8 OFDM Channel Coding

(Ships in Bundle)

Communications Systems Labs

by Dr. Sachin Katti, Stanford

1 Source Coding
2 Packet Communication, Sync, and Channel Correction
3 Modulation
4 Demodulation
5 Design Challenge:
Packet based Transceiver

(FREE: ni.com/courseware)

Stanford University - Networked Systems Group

Needs:

Exposure to real-world signals

Recruit students to RF/Communications early

Prepare students for research

Solution:

SDR Platform

Lower learning curve

Maintainable

Affordable

*"**The course evaluations for our class was fantastic.** Students rated the class 4.94/5.0, likely one of the **highest ratings among all classes** in the School of Engineering at Stanford."* ***Dr. Sachin Katti, ECE***

Stanford, CA

Research

COGEU Research – 7th Framework

instituto de telecomunicações

C O G EU

Needs:

Mobile demonstration of whitespace utilization

Multi university collaboration

Graphics: key to getting funding from non-engineers

Solution:

Affordable research platform across universities

Easy graphical interfaces to make prototypes attractive and intuitive

Low learning curve to maximize productivity

"Our students learn LabVIEW as undergraduates so they are immediately productive and the graphical capabilities allow our research projects to stand out."

Dr. Paulo Marques , Senior Research Engineer

Conclusions

- Overview of National Instruments
- LabVIEW and Its Applications
- PC-based Measurement and Control Technologies
- NI Platforms for Teaching and Research

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NATIONAL INSTRUMENTS LabVIEW CERTIFIED DEVELOPER

National Instruments ASEAN

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Hosted by NATIONAL INSTRUMENTS

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If you think your application is technically challenging, beneficial and it is an excellent showcase of computer or network based measurement and automation, what are YOU waiting for?

Submit your most innovative application to us today!

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Contest Segment

Industry	Academic	Awards Category:	Special Award of the Year
➢ 1 Winner ➢ 1 Honorary Mention	➢ 1 Winner ➢ 1 Honorary Mention	➢ Best Innovation in Biomedical & Pharmaceutical Applications ➢ Best Innovation in Renewable Energy ➢ Best Innovation in Robotics ➢ Best Innovation in Wireless Technology Applications	➢ Editor's Choice

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* All participants will be awarded a Certificate of Participation and a "Thank You" Kit

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Paper Submission Closing Date	Finalists Announcement	Results Announcement
07 June 2013 (Friday)	28 August 2013 (Wednesday)	3 October 2013 (Thursday)

- ✓ Contest Submission Forms are available at:
  - Download : **www.ni.com/asean/gsdawards**
  - Email : **asean.info@ni.com**
- ✓ Get your copy today!

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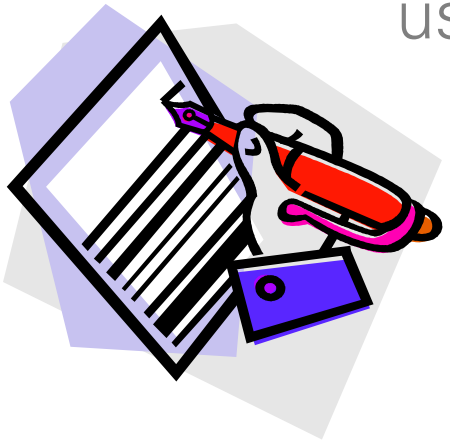

Thank You.